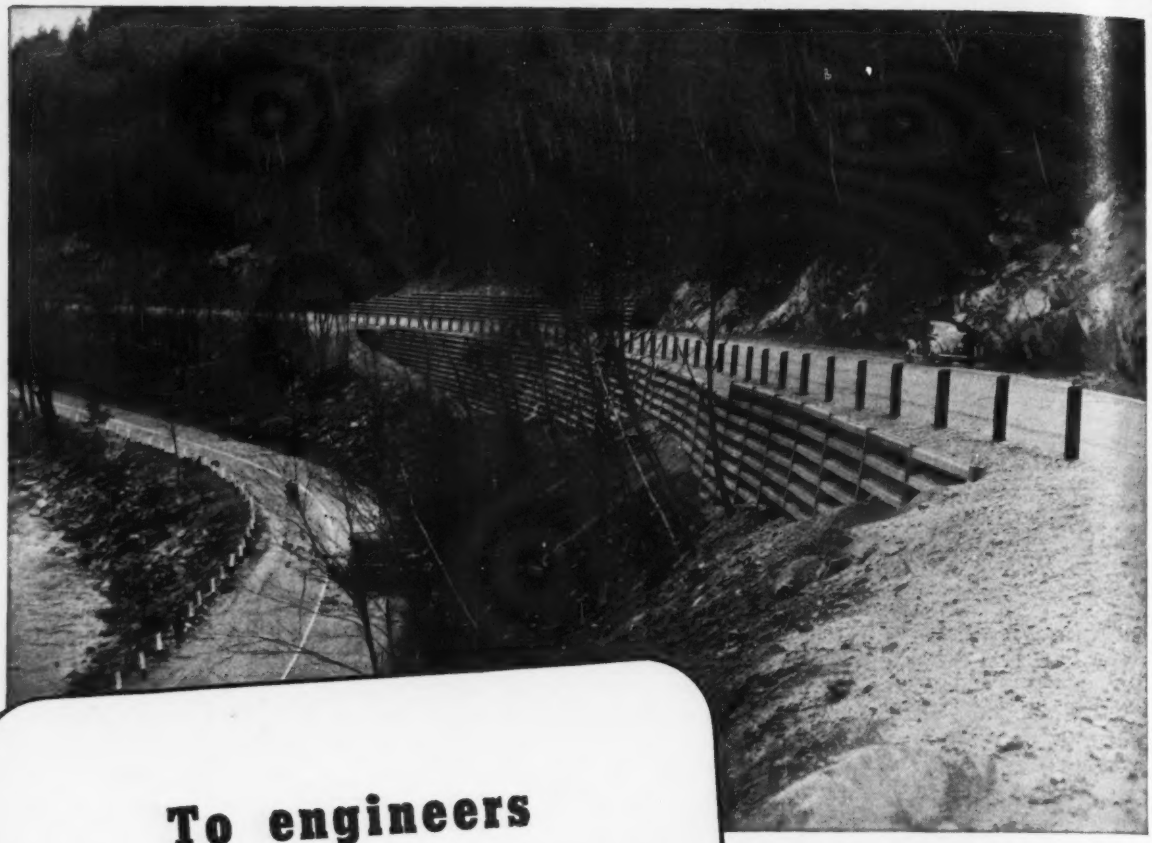
JUL 7 1943

ENGINEERING NEWS-RECORD

JULY 1, 1943

WAR BONDS
STAMPS
VICTORY



A divided four-lane highway replaces this once narrow state route. Rugged ARMCO *Bin-Type Walls stabilize the right-of-way, which is so steep in places that the two pairs of lanes are separated by elevations ranging to almost seventy feet.*

To engineers who are planning the "BATTLE OF PEACE"

America will need your plans. Millions of fighting men and other millions of war workers must some day turn to new jobs in a new and different world. You can help by planning now to avert a serious let-down when Victory is won.

No doubt you are thinking about many projects that would not only improve roads and streets, but even more important would provide jobs for returning service men and workers now in war industries. Even now industry is planning post-war developments to absorb its share of these people. If federal, state and municipal governments have their plans ready, unemployment will be less of a problem to America.

In this "board work" you may need a practical solution for unstable slopes, rights-of-way and similar problems. Remember ARMCO Bin-Type Walls for their ability to overcome unequal settlement without cracking or bulging.

So include ARMCO Walls in your plans for the future even though you can't get them for immediate construction. Right now tanks, guns and ships are most important. Armco Drainage Products Association, 365 Curtis St., Middletown, O.

ARMCO Bin-Type RETAINING WALLS

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewers, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Shipbuilding, Irrigation, Canals, Railroads

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COMING NEXT

• An appreciable amount of timber was saved and steel conserved in recent construction of three different types of Navy shop buildings. In each type of structure the roof trusses and trussed columns were of special design to effect continuity and column restraint. In the July 15 issue these several designs will be described.

• A dumping barge of unusual design and construction was used to transport and place 90-ton concrete blocks for construction of a 3,300-ft. breakwater in Portugal. A Tipping car, operating on rails set below deck level, employed a system of screw jacks to dump the blocks over the end of an overhanging beam. Design and operational features will be outlined in *ENR* for July 15.

• Experience in teaching the fundamentals of operation and control of various industrial processes have indicated the desirability of employing models for demonstration purposes. The Army is using a model of a complete sewage treatment plant for training its sanitary engineers and operators that is of unusual interest. The model will be described in the July 15 issue.

LOOKING AHEAD

• The necessity for completing fast war plant construction schedules on time has greatly influenced recent advancements in engineering and construction techniques. For instance, the need for carrying column footings at varying depths to firm soil to insure no settlement of floors under heavy loads was eliminated recently by laboratory control of compaction work after careful analysis of fill material. A forthcoming article will describe the procedure used.

• An elevated water tank of unusual attractiveness and exceptional construction interest will be featured in an early issue. Rising 120 ft., the tank is supported by a reinforced concrete wall consisting of a series of concentric rings instead of the more usual columns and bracing. The exterior wall has a fluted surface. There are two 1,000,000 gal. capacity tanks, one at top of the tower and one below ground.

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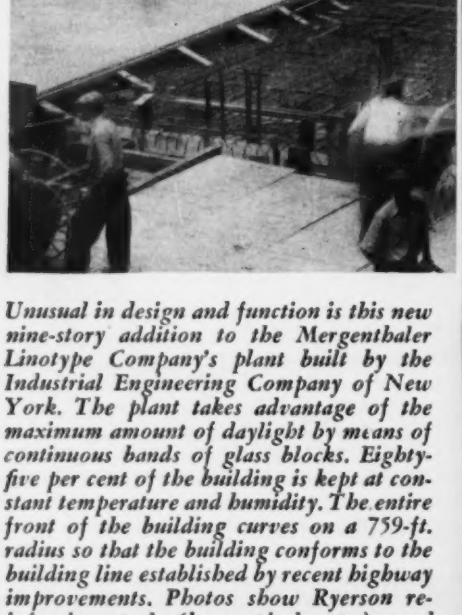


Unusual in design and function is this new nine-story addition to the Mergenthaler Linotype Company's plant built by the Industrial Engineering Company of New York. The plant takes advantage of the maximum amount of daylight by means of continuous bands of glass blocks. Eighty-five per cent of the building is kept at constant temperature and humidity. The entire front of the building curves on a 759-ft. radius so that the building conforms to the building line established by recent highway improvements. Photos show Ryerson reinforcing steels (bars, spirals, etc.), used throughout the entire structure from the ground up.

RYERSON REINFORCING STEEL-SERVICE

The Week In Engineering and Construction

ENGINEERING NEWS-RECORD • JULY 1, 1943 • VOLUME 131 • NUMBER 1

Congress appropriates funds for reclamation projects

Effort to force the hand of the War Production Board seen in Senate action favoring work on western irrigation projects.

The Senate wrote in nearly $34,000,000 for food-production irrigation before passing House Resolution 2719 (the appropriation bill for the Department of the Interior for the fiscal year 1944) which appropriates a total of $51,240,000 for the Bureau of Reclamation for construction and investigation. The bill then was sent to conference to iron out differences with the House which had made no appropriations for irrigation construction.

Just at a time when the Bureau of Reclamation is granted the largest sum ever allocated to it for irrigation, it is in large part prevented from expending the money because of War Production Board stop-orders which have been in effect since last fall on most of the projects for which the new money is appropriated.

If approved, this will be the first time that the Congress has seen fit to appropriate funds in the face of a WPB order which forestalls their use. The Senate's passage of the bill, however, was closely followed by WPB's approval of priority ratings for Friant Dam and the Madera Canal, on which stop-orders have been lifted. More than ten and one half million dollars is appropriated for these facilities and the Friant-Kern Canal (all a part of the Central Valley project in California).

Both Friant Dam and Madera Canal are well on the way toward completion. The dam, itself, is complete except for drum gates and control valves and miscellaneous installations.

The WPB also has given ratings on a modified program for the Gila (Ariz.) project which, besides irrigation, also includes a dust-control program to protect the Yuma air base. This latter work already is underway.

In order to have the other stop-orders lifted, not only must the Reclamation Bureau make its appeal to WPB, but it is also necessary for the War Food Administration to recommend to WPB the lifting of stop-orders. This has been done on eight of the projects, and WFA now has under consideration similar recommendation for the rest of the irrigation program.

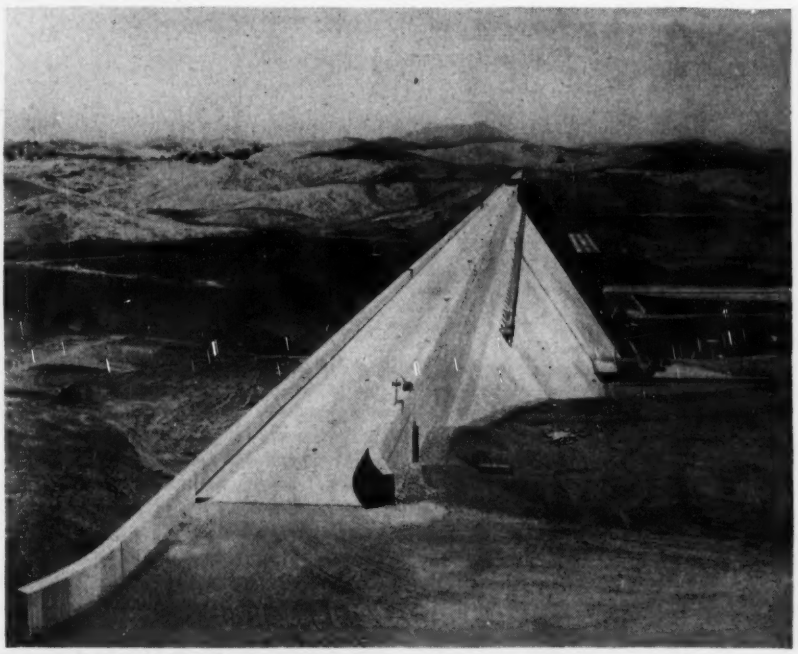
When this has been done, the WPB then takes into consideration the particular stage of the projects, and determines whether or not their utility warrants the use of critical materials.

The stop-orders of last fall were issued on the grounds that the material required for the projects was more urgently needed for ships, munitions and guns. Reclamation, however, claims that it could go ahead with much work without even having priority ratings for material. Of critical materials, the bureau's greatest need is for concrete and reinforcing steel. In this connection, a letter addressed June 8 by H. G. Batcheller, director of the WPB steel division, to Senator Hayden of Arizona says:

"The grade of steel from which reinforcing bars are rolled is not considered critical at this time, and with the essentiality established, the tonnage you require should be readily available from (1) current stocks, (2) producers of rail-steel bars, or (3) producers of billet steel using top cuts, discard, etc.

"The facilities of producers and fabricators are not now being fully employed due primarily to the gradual completion of the war construction program. We can foresee no appreciable change in this situation for the duration." His statement concerning availability refers to the entire food-production irrigation program.

(*Continued on page* 58)



Looking along the roadway atop the Friant Dam

Friant Dam is one of the major elements of the Central Valley project in California for which Congress has appropriated money to carry the work to completion. The Modera Canal takes off below the dam, the control works being in the right center.

Shortage of qualified engineers becoming acute in war work

War Manpower Commission says many engineers in work unnecessay to the war must transfer to more essential activities this year

Thousands of engineers now employed on jobs not essential to the prosecution of the war must transfer before the end of the year to more essential activities where a shortage of qualified engineers that threatens to become acute is developing. This is the essence of a report made to Paul V. McNutt, chairman, War Manpower Commission, by the National Roster of Scientific and Specialized Personnel of the commission's bureau of placement, Mr. McNutt announced June 17.

It is indicated in the report that from the beginning to the end of 1943, there should be an increase from 40,000 to 50,000 in the total number of engineers in essential civilian work and in the armed forces.

Nineteen percent in war work

It is estimated that at present there are about 280,000 American professional engineers, of whom 19 percent are in the armed forces and in civilian jobs in the War and Navy departments. Twelve percent are in other governmental positions; 49 percent are employed in manufacturing, mining and construction; while 20 percent are employed in transportation, communication, public utilities, private consulting offices, colleges and universities.

Most acute shortages of engineers, it was explained, occur in the field of electrical, radio, mechanical, aeronautical, marine, and industrial engineering. A shortage also exists in the fields of chemical, metallurgical, and sanitary engineering.

Less civil engineering work

As a result of completion of most war construction projects, a number of engineers, principally civil engineers, are being made available for work in other projects, such as aircraft construction, shipbuilding, and factories of all kinds. The report states that young, adaptable civil engineers with recent training in mathematics and physics who have had some courses in electrical or radio engineering, might, after some special training, be employed in a technical capacity in connection with radio detection, in which field there is a great demand for technical personnel.

The report points out that war industry is passing through its most critical phase, from the standpoint of engineering personnel needs. "More engineers are required to start production and raise production rate to capacity," it is stated, "than are required for normal operation. When manufacturing plants reach the stage of routine production, they can better stand the loss of some of their technical personnel to the armed forces without curtailing operations."

Special training needed

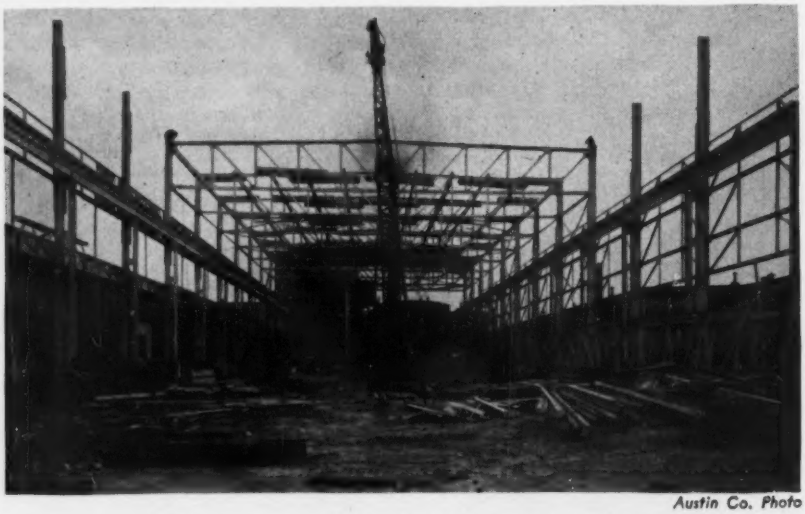
Training programs can assist in meeting present and future technical personnel needs, the National Roster report stated. The simpler engineering tasks may be turned over to technical assistants, it was explained. Skilled workers may be upgraded, working full time at their highest skill, while less technical operations may be performed by men and women with more limited technical training.

The government-sponsored Engineering, Science, and Management War Training courses in the colleges, for which high-school graduates are now eligible, can provide many of these technically trained men and women to help out in the present emergency. Likewise many civil engineers may take short training courses that will enable them to fill in the demands for other types of engineers.

The senior classes in all engineering colleges numbered only 17,000 for the academic year 1942-43, the report states. Of this 17,000, a survey of the engineering schools made by the National Roster in October and November, 1942, showed then an estimated 6,400 were committed to the armed forces through the enlisted reserve programs.

Engineers for industry

The military training of the nearly 40 percent of the present senior engineering students committed to the armed forces through membership in reserve components, is nominal, it was added. Except to the extent that these new engineers are needed to fill technical posts in the armed forces, it is felt that serious consideration should be given to releasing some of them to war industry—particularly those who have specialized in the most critical industrial engineering fields.



Austin Co. Photo

Salvaged metals used in new building

With WPB orders prohibiting the use of steel in war plant construction still in effect, scenes like the above, showing construction of the latest addition to Tube Turns' plant at Louisville, Ky., hold a special interest. The Austin Co. designer and builder of the plant, refabricated for the framework more than a hundred tons of wrought iron and an equal amount of used steel which was salvaged from the old Louisville postoffice. The only new steel in the structure is the 60-lb. crane rail.

The structure is 220 ft. long and has a clear span of 80 ft., with 35-ft. clearance below the trusses and 28 ft. below the crane runway. It is being equipped with a used 10-ton crane and is inclosed with a wood roof and wood ventilating sash.

The wrought iron has been used in the truss webbing, bracing, eave struts, girts and stub columns, while the 43-ft. columns and top and bottom chords of the 80-ft. trusses were made from second-hand steel. All of the structural members were welded in the Austin shops at Cleveland and have riveted field connections. The wrought iron, originally produced more than 70 years ago, was found to be practically free of rust. While fundamental characteristics of the material called for special precautions, the cross-section conforms in all respects to a modern welded structure.

Doherty named head of engineering educators

Robert E. Doherty, president of Carnegie Institute of Technology, Pittsburgh, was elected president of the Society for the Promotion of Engineering Education at the society's 50th annual meeting in Chicago. Mr. Doherty is an engineering graduate of the University of Illinois and took post-graduate work at Union College. He served with the General Electric Co. in its testing and design departments from 1909 to 1931. In 1931 he was named dean of the engineering school at Yale, and was elected president of Carnegie Tech in 1933.

WASHINGTON HIGHLIGHTS

The Navy appropriation bill, now ready for the president's signature, provides $1,855,317,405 for public works and public utilities, Bureau of Yards and Docks, together with unexpended balances of previous appropriations, for completing projects already undertaken, and for construction of temporary buildings and facilities. Funds are not available for permanent construction at shore establishments acquired since 1938. Fixed fees for contractors could not exceed six percent of the estimated cost of the contract, exclusive of the fee, according to the bill as passed by the House, but the percentage was reduced to four by the Senate, and the conference report was accepted by both houses. The bill also appropriates $160,000,000 for mobile floating drydocks and facilities.

The $71,000,000,000 Army bill, which includes an appropriation of $2,475,161,500 for the Corps of Engineers for all engineer service, was passed by the Senate June 29. The amount includes $1,893,349,000 for design, development and procurement of equipment and machinery for training troops and for the operation of the engineer school; and $582,912,400 for construction at military posts of buildings, utilities, flying fields and fortifications.

A bill introduced in the Senate by Senator Lucas of Illinois to amend the Flood Control Act of 1936 underwent some changes in the commerce committee before being favorably reported out. The bill provided that unexpended balances appropriated under the act—amounting to about $30,000,000—could be used now. This was cut to $10,000,000 on word from the Army engineers that this would be adequate. The Lucas amendment would have authorized increases in the height of existing levees. It also sought funds to replace existing levees, but that was not approved. However, the War Department will make a study of the entire Mid-West flood area to recommend an overall, long-range flood control program for repairing levees and other flood-control structures destroyed or damaged by recent floods.

• • •

Melville, Chief Engineer, Canadian Army Overseas

Brigadier General J. L. Melville of Ottawa, 54, has been appointed Chief Engineer of the Canadian Army Overseas, succeeding Major General C. S. L. Hertzberg of Toronto.

General Melville is a native of Glasgow, coming to Canada in 1913. In the last war he served overseas with the Royal Canadian Engineers and went overseas again in June, 1940, in command of the first battalion, Royal Canadian Engineers. Subsequently he was appointed commander, R.C.E., at Canadian Corps Headquarters, and later chief engineer of a Canadian Corps, when the Canadian overseas army was enlarged, with the rank of brigadier general.

• • •

C.&O. Railway tunnel holed-through in Virginia

A railroad tunnel 4,000 ft. long at Afton, Va., on the Chesapeake and Ohio Railway's main line between Richmond and St. Louis was holed-through June 19 at 2:30 p.m., just a little over a year after drilling operations were started. When completed, this 18-ft. wide x 22-ft high bore through the main ridge of the Blue Ridge Mountains will replace an old tunnel of inadequate size.

Construction of this million-dollar project, built by Bates and Rogers Construction Corp., Chicago, is described in an article starting on page 70 of this issue.

Ohio road workers help in farm labor emergency

The Ohio farm bottleneck created by adverse weather conditions and shortage of labor has been broken by the use of Ohio Department of Highway tractor equipment and workers. More than 900 acres a day were plowed, disked and harrowed in 47 northern and central Ohio counties.

One of the department of tractors is shown above being hitched to two harrows, while Highway Director H. G. Sours, right, and J. P. Shumaker, division chief engineer, observe Wilbur Wolf, state employee, at his work. Director Sours estimates a minimum of 9,000 acres of rich Ohio farmlands which otherwise would not have been fitted in time for planting of corn were prepared by highway department equipment and men within ten days. Through the action of Governor Bricker and Director Sours in putting state equipment to work on farms, at least 360,000 bu. of corn are expected to be added to the harvest.

Use of Ohio equipment on private farms is believed to be the first such action anywhere in the United States, but on June 9 members of the state highway maintenance crews of Kentucky were given permission by Governor Johnson to "lay off and help farmers" plant rain-delayed crops. J. E. Stanford, executive secretary of the Kentucky State Farm Bureau Federation, had telegraphed the chief executive asking aid and declaring the "already critical farm situation has been further exaggerated by extremely unfavorable weather. If the farmers do not get immediate help it is likely one-fourth, to one-third of the planned crops will not go into the ground."

News of the Oil Pipelines

Pipelines, new and old, are of much interest at the present time on account of their potential influence on the solution of pressing oil and gasoline supply problems. Here is news from four of the pipeline fronts:

New Jersey—Four dynamite blasts on June 16 and 17 opened a trench in the bed of the Raritan River in Franklin Township for the Big Inch pipeline, which is nearing completion from Longview, Tex., to one of its terminal points in Bayonne, N. J. (*ENR*, Dec., 1942, p. 915). A trench already has been blasted in the bed of the Delaware and Raritan Canal which runs alongside the river at this point. Only the Rahway River remains to be crossed.

Because of the shallow water in the Raritan River, the trench had to be blasted in four stages, Walter Lewis, foreman for O. C. Whitaker Co., in charge of construction, said. The first charge contained 1,250 lb. of dynamite. While not as spectacular as the blast in the canal, which sent a spray of water a quarter of a mile, this blast hurled rocks and pieces of dirt to Canal Road, nearly that distance from the river.

While dynamite workers were stringing the charges half way from shore in the river, other workmen were building an earth dam across the canal. Under the dam, three large steel pipes will carry the canal water to a point 100 ft. below the trench into which the oil pipeline will be placed. After the Big Inch is placed, the canal bed will be reopened.

When the gang reaches Rahway, where a web of lines will carry the oil to the nearby Bayonne refineries, the workmen will start building a second parallel line, 50 ft. from the first, leading back to Texas.

Washington, D. C.—Opening of the first petroleum products pipeline into the District of Columbia—a 6-in. line capable of delivering 21,000 gal. an hour to a newly constructed terminal in Washington—was announced by the Sinclair Refining Co. on June 16. At the same time company officials disclosed that 2,000,000 gal. of fuel oil and 350,000 gal. of kerosene already have been received through the new line, which has been in partial operation for several weeks. Gasoline will be piped into Washington upon completion of an underground gasoline storage tank of 1,800,000-gal. capacity.

Announcement of the new source of fuel supply for the district came as a surprise to most consumers. The 458-mile pipeline has been under construction since October, 1941.

Likewise completed was the local terminal, construction of which has been under way since last October. According to B. P. MacKenzie, resident manager for the Sinclair Co., the new terminal has storage capacity for 4,800,000 gal. of petroleum products.

While the line could supply 65 per-

Big Inch Movie

One of the best technical motion pictures on construction operations now available is *Oil for War*, a documentary film of the Big Inch pipeline project.

Filmed in color and accompanied with a narrative sound track, it is being shown by the Barrett Division of the Allied Chemical and Dye Corp., who furnished protective coatings for the steel pipeline.

Inquiries concerning availability of the picture may be addressed to G. B. McComb, Pipeline Department, The Barrett Division, 40 Rector St., New York City.

cent of all petroleum needs in the Washington area if Washington received the entire flow from the line, the district must share the supply with 19 other stations located along the route.

Arkansas—The B. & M. Construction Co., of Oklahoma City, Okla., contractors on the 101-mile pipeline project near Jonesboro, Ark., will set up headquarters in that city immediately. The contractors plan to employ some 500 men on the project with a weekly payroll of about $25,000.

New England—Local authorities, in conjunction with the Petroleum Administration for War and company oil interests, are giving consideration to the construction of a 165-mile pipeline to connect Albany, N. Y., and Boston, Mass., with the principal objective of insuring deliveries of oil products to New England during the winter, it has been reported authoritatively.

Plans call for a 10-in. line from Rensselaer, N. Y., on the east bank of the Hudson River opposite Albany, to West Boylston in east central Massachusetts, and an 8-in. line from that point to the Boston area.

The 10-in. section would have a capacity of 60,000 barrels a day and the 8-in. link 36,000 barrels a day. The line would be used primarily for transportation of heating oil and kerosene, two products in which a critical shortage existed in Boston and other New England communities last winter. The products would be transported to Albany by rail over the New York Central railroad lines and by the barge canal.

• • •

N. Y. municipal officials ask less federal control

At the 34th annual meeting of the New York State Conference of Mayors and Municipal Officials held in Albany on June 9–11, a predominant theme was opposition to proposals that the federal government inaugurate a glorified public works relief project during the postwar period.

Many speakers were of the opinion that free enterprise, upon the removal of federal restrictions, could adequately cope with the situation of providing employment for the stabilization of the national economy.

It was repeatedly brought out that federal aid for public works, housing, education and other local public activities, involved operations under federal directives, with the ultimate result that home rule and local government gradually becomes submerged under bureaucratic control from Washington.

It was again restated that local government is the true foundation upon which the American manner of life is built and that if the continued encroachment of the federal government into local affairs is not promptly checked, our form of government will gradually decline towards total federal control.

Financing local work

Municipalities were cautioned to reduce their current expenditures sharply in order to better provide for the financing of their local postwar public improvements, which should be limited, so far as possible, so that just enough employment would be furnished to fill the needs of the men as they return home from both war and industry service.

It was pointed out that while realtors, editors and various taxpayers associations have claimed local taxes are getting so high as to "ruin" the taxpayers, little mention is made of the fact that the increase in the past few years of the federal income tax alone has been equal in many cases to more than doubling the local tax rate.

The concensus of the conference was that above all things the winning of the war must come first, but that at the same time adequate planning must be carried forward so that municipalities may proceed in a sound and orderly manner to conduct local affairs in the postwar period without too much impairment of the already heavily burdened taxpayers.

Inter-American Highway Diary

Editor's Note—This fourth installment of A. N. Carter's diary completes his report of his travels to see various parts of the Inter-American Highway job in Costa Rica. Additional sections of the diary will be published in subsequent issues.

A. N. Carter Assistant Editor, Engineering News-Record

San Jose, Costa Rica—An active Sunday (May 16). I spent the morning with M. L. Harshberger and Norman Wood of PRA on a visit to the extensive repair shops which Ralph E. Mills has set up at Cartago, about 35 miles southeast of San Jose.

May 17-18—We used about every available type of transportation at some time during our last two days in Costa Rica. The plan was to make a trip over the 22-mi. access road being built by the Ralph E. Mills Co. from the port of Dominical to the route of the Inter-American Highway at the small town of San Isidro, Costa Rica. Dominical has no harbor facilities; instead, equipment must be deliver on barges that are grounded at high tide and unloaded at low tide.

In company with M. L. Harshberger and Norman Wood of the PRA, I left the San Jose airport at 5:30 for San Isidro, an hour's ride to the southeast. We rode in a Ford tri-motor cargo plane owned by the TACA Airlines (Transportes Aereos Centro Americanos). The other cargo consisted of 3,600 lb. of freight, including 4 drums of oil, two or three big gunnysacks stuffed with loaves of bread, and some drill steel needed on the highway.

After breakfast at the Mills' camp, where H. R. Stewart is superintendent, we travelled over the first five miles of the access road in a jeep driven by Stewart. For the next half mile or so we had to travel on foot through heavy mud. Travel from here for the next six and seven miles was on a tractor equipped with a irame to carry passengers and freight. That took two and one-half hours. Reaching a better road, we transferred to an army station-wagon for the rest of the trip to Dominical, where Mills also has a labor camp and where we arrived in time for lunch.

The afternoon was spent with Joseph A. Stone, field superintendent on the access road for Mills. We visited his quarry sites and watched the American-made equipment crushing and placing rock. Time also permitted a tour through the repair shops and garage at Dominical and an inspection of the small hospital, bunkhouses and kitchen facilities at that camp.

Originally we were to leave Dominical early in the afternoon for Puerto Quepos, 30 mi. up the coast to the north, a port used for shipping bananas by United Fruit Co., and where freight is unloaded from ocean-going vessels for transhipment by barge to Dominical. However, we did not get away from Dominical until after dark, and when we did go, we were transported out to the 40-ft. launch we were to use in a native canoe hewn from a large log, and known as a cayuco.

The 2½-hr. ride to Puerto Quepos was not only cool, in contrast to the extreme heat of Dominical, but was a moonlight trip with large white clouds over head and the mountains of the Costa Rican coast in the distance on the right. We arrived at Puerto Quepos at about 10 o'clock, where we spent the night in a comfortable cottage owned by the United Fruit Co.

Early the next morning and without breakfast we made a 1-hr. trip from Puerto Quepos to Parrita, Costa Rica, in a Dodge coach operating on the railroad used by the United Fruit Co. for hauling bananas to the dock. We reached Puerto Quepos shortly after seven. A breakfast of hard rolls, a can of tuna fish and a glass of orange juice, bought in a small store run by a Chinaman, was eaten on the edge of a nearby banana plantation.

The Taca plane in which we were to travel back to San Jose was late; eventually we got away at 11 o'clock and we were in San Jose in about one half an hour. This last speedy trip is a decided contrast to the difficult, three-day trip by horseback from Parrita to San Jose that would have been necessary had there been no plane.

May 31—After more than a week spent in San Jose getting information on both the Inter-American Highway and public-works construction in Costa Rica, I left at noon by Pan American Airways for Managua, Nicaragua. My notes on the notable construction work in Costa Rica are too voluminous to include here. They will be published at a later date.

Much of the air trip to Managua was over Lake Nicaragua. The volcano Ometepe, rising out of the lake to an elevation of 4,300 ft., was a refreshing sight but poor preparation for the heat of Managua, where we arrived at 2 p.m.

After a call on Col. W. W. Zass, area engineer for the Army, and Juan Ignacio Gonzales, minister of Public Works for Nicaragua, I was fortunate in being invited by engineers of the Swinerton-McClure-Vennell contracting organization to spend the night at their staff house.

(To be continued)

Route of the Inter-American Highway, which is the strategic link of the Pan-American highway system through Central America. It is 1,530 miles in length.

JOBS OF THE WEEK

PLANT, Ohio

Austin Co., Cleveland, O., has been awarded contract to construct factory additions by Diamond Alkali Co., Painesville, O. The estimated cost will be $1,000,000. Defense Plant Corp. will finance.

HOUSING, Allentown, Pa.

Robbins Homes, Inc., Allentown, Pa., will build housing by own forces. The estimated cost will exceed $700,000.

HIGH SCHOOL, Bremerton, Wash.

Sound Construction & Engineering Co., Seattle, Wash., was lowest bidder for constructing high school, when Bremerton School Board, Bremerton, opened bids June 24. Naramore & Brady, Seattle, Wash., are architects. Federal Works Agency will finance. The estimated cost is $829,000.

BUILDINGS, New York

U. S. Engineers, New York, N. Y., will construct temporary buildings in Suffolk County. Roberts Nash Construction Corp., Flushing, N. Y., was awarded the contract at an estimated cost of between $500,000 and $1,000,000.

PAVED SHOULDERS, New York

U. S. Engineers, New York, N. Y., awarded contract for paving shoulders, Suffolk County, to William P. McDonald Corp. and Good Roads Engineering & Contracting Co., Inc., Flushing, at cost of $500,000-$1,000,000.

GRADING, PAVING and DRAINAGE, North Carolina

Mecklenburg Construction Co., Inc., Durham, N. C., has been awarded contract for grading, paving, drainage in Forsythe County by U. S. Engineers, Wilmington, $500,000-$1,000,000.

IMPROVEMENTS, New Jersey

Johnson, Drake & Piper, Inc., New York, N. Y. and S. J. Groves & Sons Co., Ridgefield, N. J., have been awarded contract for improvements, Essex County, by U. S. Engineers, New York, N. Y. Estimated cost is $4,000,000.

DEPOT, Halifax, N. S.

James N. Kennedy, Halifax, N. S., has been awarded contract for depot at Willow Park for Department of National Defense (Army), Ottawa, Ont. The estimated cost is $810,000.

BARRACKS, SCHOOLS, New London, Conn.

Bureau of Yards and Docks, Navy Dept., Washington, D. C., will construct superstructures for barracks, schools, ward dispensary buildings, laundry addition, and installing facilities at Submarine Base. Wadhams, May & Carey, Hartford, Conn., will do the work for $726,374.

DWELLINGS, Philadelphia, Pa.

Nelson-Pedley, Inc., Philadelphia, Pa., have been awarded contract for 408 two-story dwellings, at the Roxborough Country Club site, Ridge Ave. and Gates St. for Wissahickon Hills Corp., Philadelphia, Pa., $2,500,000.

IMPROVEMENTS TO AUXILIARY AIR STATION, California

Johnson, Drake & Piper, Inc., Oakland, Calif., has been awarded contract for additional aviation improvement to auxiliary air station, Crows Landing, by Bureau of Yarks & Docks, Navy Dept., Washington, D. C., at $572,900.

HOUSING, Virginia

Public Housing Authority, Washington, D. C., received lowest bids on housing from Caristo Construction Corp., Brooklyn, N. Y., on schedule 1, $1,537,050; Schedule 1A, $1,532,550; from William R. Goss, Washington, D. C., Schedule 2, $1,368,000; Schedule 2A, $1,414,500; from Tovel Constr. Co., Baltimore, Md., Schedule 3, $1,769,900. Faulkner & Kingsbury, Washington, D. C., are architects.

OIL REFINERY, Paulsboro, N. J.

The Lummis Co., New York, N. Y., has been awarded contract by the Socony Vacuum Oil Co., Paulsboro, N. J., for oil refining unit, including buildings, process piping, storage tanks, at an estimated cost of $1,250,000.

WAREHOUSE, California

U. S. Maritime Commission, Oakland, Calif., will construct two 200x420 ft. warehouses, one 220x960 ft. warehouse, and one 180x1,500 ft. warehouse. Moore & Roberts, San Francisco, Calif., have been awarded the contract. The cost will be about $1,000,000. H. J. Kaiser Co., Richmond (engineering dept.) prepared plans.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News sections beginning on page 141.

Congress gives more aid to reclamation projects

(continued from p. 53)

Irrigation projects halted and the amounts voted them by the Senate include (besides those already mentioned):

Boise (Idaho project, Payette Div. (Cascade Dam)	$500,000
Deschutes (Ore.)	250,000
Klamath-Modoc (Ore.-Cal.)	420,000
Riverton (Wyo.)	500,000
Shoshone (Wyo.) Heart Mt. Div.	350,000
Colorado-Big Thompson	3,600,000
Boise (Idaho) Anderson Ranch Dam	4,100,000
Lugert-Altus (Okla.)	1,985,000
Tucumcari (N.M.)	1,200,000
Wyakima (Wash.) Roza Div.	1,415,000
Delta Division (Contra-Costa)	2,686,000
Gila (Ariz.)	1,000,000

The total of $51,240,000 appropriated for construction and investigation includes four million for the following water conservation and utilization projects: Mancus, Colo.; Rapid Valley, S. D.; Newton, Utah; Buffalo Rapids, Mont.; Mirage Flats, Neb.; Eden, Wyo.; all of which are under construction, and two others, Bully Creek, Ore., and Cambridge, Neb., yet to be authorized. The total also includes two million for general investigation of projects for the postwar program for power and irrigation and other multiple-use purposes. The total further includes $15,374,000 for Shasta and Keswick dams and Shasta power plant and Oroville transmission lines of the Central Valley project in California, for which the WPB has already granted priorities because of the power features.

It is estimated by the Bureau of Reclamation that if the program goes forward as planned, its irrigation service will be extended by 1945 to 1,280,000 acres in 13 western states.

• • •

J. C. Page retires as Reclamation Commissioner

President Roosevelt has accepted the resignation of John C. Page as Commissioner of the Interior Department's Reclamation Bureau. Mr. Page wrote the President on June 12 that he was submitting his resignation because of ill health and wished it to become effective whenever Mr. Roosevelt and Harold L. Ickes. Secretary of the Interior, desired.

In a letter of reply, the Chief Executive disclosed that Mr. Ickes had persuaded Mr. Page to remain in government service in the capacity of a consulting engineer. For some time H. W. Bashore has been acting commissioner.

OBITUARY

Albert T. Sprague, 67, since 1906 superintendent of structural maintenance for the Boston Elevated Railway, died at Revere, Mass., June 24.

Walter I. Swanton, 73, an engineer of the United States Reclamation Service until his retirement in 1940, died at Newton, Mass., June 22. He was born in St. Joseph, Mo., and was graduated from the Massachusetts Institute of Technology in 1893. He was employed for a time by the Boston & Albany Railroad, worked at the Norfolk (Va.) Navy Yard, and was engaged in many western irrigation projects during his career.

David A. Hemstreet, 45, Marysville, Calif., contractor, of Hemstreet & Bell, was accidently killed June 22. Hemstreet was director and past president of the Northern California Chapter of the Associated General Contractors.

George Condit Hayden, 81, a retired civil engineer for the War Department, died June 23, at his home in Kansas City, Mo. He was born in Rome County, Mo., and lived in Kansas City the last 35 years. He was a member of the American Society of Civil Engineers.

Joseph Brazos, 83, nationally known road building contractor and formerly vice-president of the Connecticut Road Building Contractors' Association, died at Middletown, Conn., June 10. Mr. Brazos was a director of the Portland Company which controls the brown stone quarries in Portland, Me.

E. M. Knox, 42, city manager of High Point, N. C., died June 19. He was president of the International Association of City Managers. He was also president of the North Carolina League of Municipalities in 1935 and 1936.

Louis Yorston, 68, prominent in engineering circles in the Maritime Provinces and Montreal, Que., died at Pictou, Nova Scotia, June 11. Mr. Yorston was educated at McGill University and was on the engineering staff of the Montreal Power Company until 1917, and was associated with power development at Lachine, Chambly, Shawinigan and other Quebec points.

CONTRACTS AND CAPITAL

CIVIL ENGINEERING construction in continental U. S. totals $60,148,000 for the week. This volume, not including the construction by military combat engineers, American contracts outside the country, and shipbuilding, is 12 percent higher than in the preceding week, but is 72 percent below the volume reported for the corresponding 1942 week.

Private construction tops a week ago by 52 percent, and public work is 9 percent higher due to the 17 percent increase in state and municipal work, and the 9 percent gain in federal volume. Comparisons with the 1942 week, however, reveal private construction down 76 percent; public work off 72 percent; state and municipal down 62 percent; and federal volume off 73 percent.

The current week's construction brings 1943 volume to $1,826,400,000, an average of $70,246,000 for each of the 26 weeks. On the weekly average basis, 1943 volume is 63 percent lower than the $5,123,117,000 for the 27-week 1942 period. Private construction, $227,347,000, is 35 percent lower than a year ago, and public construction, $1,599,053,000, is down 65 percent when adjusted for the difference in the number of weeks.

New capital for construction purposes for the week totals $2,412,857,000. It is made up of $1,369,000 in state and municipal bond sales, $10,000,000 in corporate security issues, and $2,401,488,000 in federal departmental appropriations for construction.

The week's total brings new construction financing to $2,909,923,000 for the 26 weeks of 1943, a volume that is 61 percent below the total of $7,799,044,000 for the 27-week period last year.

CONTRACTS

Continental U. S. Only
(Thousands of dollars)

	Week Ending July 2 1942	June 24 1943	July 1 1943
Federal	$183,776	$45,986	$49,988
State & Municipal	13,804	4,544	5,297
Total public	$197,580	$50,530	$55,285
Total private	20,243	3,212	4,863
TOTAL	$217,823	$53,742	$60,148
Cumulative 1943 (26 weeks)			$1,826,400
1942 (27 weeks)			$5,123,117

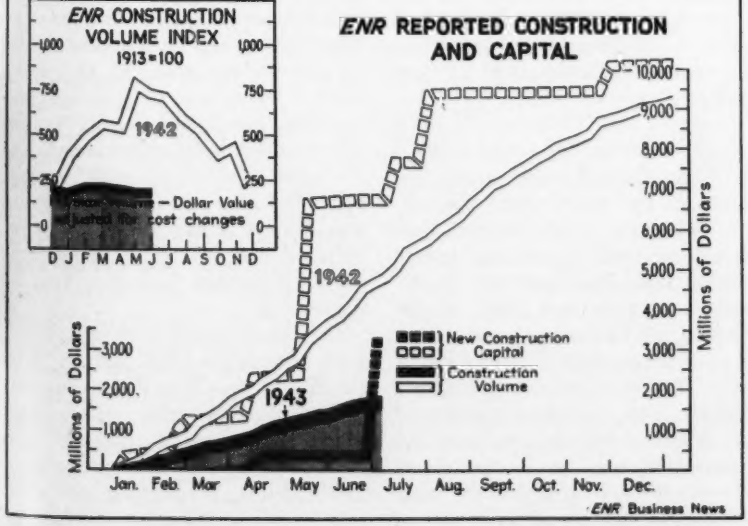
Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

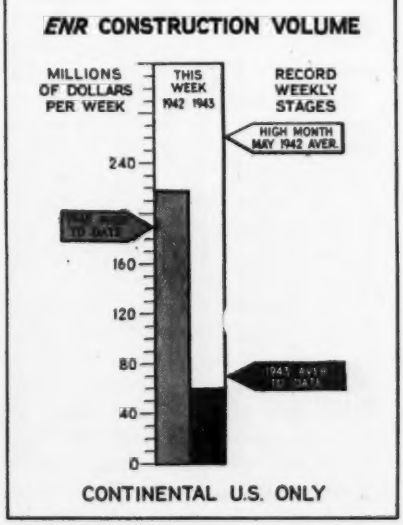
NEW PRODUCTIVE CAPITAL

	Cumulative 1942 27 weeks	1943 26 weeks
NON-FEDERAL	$517,628	$256,085
Corp. Securities	150,959	13,571
State & Mun.	156,190	82,381
R.F.C. loans	127,419	9,000
FPHA loans	.....	3,133
R.E.A. loans	.....	20,000
Fed.-Aid Hhwy.	82,700	128,000
FEDERAL	$7,281,776	$2,653,838
TOTAL CAPITAL	$7,799,044	$2,909,923

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	July '43	289.92	139.36
Building Cost	July '43	227.89	123.19
Volume	June '43	204	.89


ENR CONSTRUCTION VOLUME INDEX 1913=100
1942
Dollar Value
Adjusted for cost changes
D J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
1942
1943
New Construction Capital
Construction Volume
Millions of Dollars
Jan. Feb. Mar Apr May June July Aug. Sept. Oct. Nov. Dec.
ENR Business News



Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Check and Double-Check

Sir: Your editorial, "Fantasy of the Far North" (*ENR* June 3, 1943, p. 791), is most interesting, but I am afraid it contains one unsound engineering statement.

If your proposed subway is ventilated with a pipe exhaust from Washington, what will prevent the ice-block lining melting and causing the project to be endangered?

F. W. PIRIAN
New York City

[All the engineering data were carefully checked and these revealed, among other things, that the cool reception given to Washington exhaust would reduce the temperature far below the melting point of ice.—The Editors]

South American Waterways

Sir: The article, "Inland Waterway for South America," appearing on p. 360, in your issue of March 11, 1943, brings attention to a very ambitious plan, but ones whose realization is essential to the full development of that continent's interior. Unfortunately, the cost of such a project will probably relegate it to the dis tant future.

By way of pioneering such a route, however, use might be made of a comparatively inexpensive expedient, the portage railroad. Such railroads have proved successful in the development of the Congo River route. The construction of the best known example in the western hemisphere, the Madeira-Mamore Railroad, proved very expensive, not only in money, but in human lives. By using the experience acquired at that time and subsequently, such projects in the future should be less costly.

The necessity of handling cargo at each end of these railroads slows its movement and makes it expensive. By equipping each terminal with heavy-duty cranes and loading all suitable types of freight into large containers, or demountable vehicle bodies, this process could be expedited and cheapened. These containers could be of a size to fit meter-gage flat cars or large trucks. They would be crane-handled from boat, or barge, to railroad car and vice versa.

A railroad would be built between the head of navigation on the Paraguay system and that of the nearest tributary of the Amazon, probably the Mamore. Northbound containers would be barged from this point to the Madeira-Mamore falls, where they use the existing railroad. They would then be shipped by water down the Madeira to the Amazon. At the other end of the waterway it might be more economical to connect the Amazon and Orinoco systems by rail than to improve the natural water connection.

This system of transportation might be extended to other tributaries of the Amazon and La Plata that are broken by waterfalls. In some instances all-weather roads might be built initially instead of railroads.

When the traffic justifies it these portages could be replaced by lock canals. In the meantime the interior of South America would enjoy comparatively cheap and rapid freight service.

R. N. GRAHAM,
New Orleans, La.

In Defense of WPA

Sir: Your editorial, "The End of WPA" (*ENR* Dec. 17, 1942, p. 837), and your willingness to hold a forum, prompt me to express my opinion.

Charging that "On its record WPA was not a success," you have indicted WPA on the following counts, but you have not proven your charges: (1) Manpower and money were wasted; (2) Self-respect was lowered through unlimited funds which concentrated power over men in adversity; (3) Engineering and the art of construction were degraded to the point of destroying manpower and abilities; (4) It made a travesty of the definition of the engineer and construction man as an individual who can do well with a dollar what any bungler can do with two after a fashion; (5) It contained no kernel of permanent cure for unemployment; and (6) It turned sickness into a chronic disease.

In order to convict under an indictment, the defense and prosecution must be heard and the jury then decides which witnesses and which facts it believes. Before presenting my facts, may I request that all look at the record?

During the prosperous twenties no one gave much attention to the unemployed, although there were millions of them; it was not until the early thirties that the percentage of employable unemployed became so large as to create the most serious problem this country has ever faced. Even the usual road warning signs bearing the words "Men Working" were considered political propaganda. Then came the real dark days—banks failing, life savings gone, homes being lost, employable men selling apples on street corners; weary, disheartened men not knowing which way to turn or where to look for guidance. All groups—industrialists, capitalists, editors, preachers, engineers, architects, labor groups, were calling on their chosen representatives, legislators, Congress and the President, to do something — anything—to put men to work.

Getting men to work

The professional engineers and allied groups advanced the idea of a large federal works program, and about the middle of 1933 the PWA legislation was passed. We thought the problem had been solved. PWA met all the requirements—adequate plans, specifications and supervision by professional men, contribution by the sponsor and a contribution by the government, work let after competitive bidding to responsible contractors. But by the first of November the PWA had hardly started. The President was faced with another horrible winter and the only solution was still, as it had always been, get men to work. The problem was how to do it quickly, and how long to continue it.

On Nov. 15, 1933, the CWA (which later became the ERA, and, in 1935, the WPA), was launched. Representatives of states (the writer represented New Jersey), counties, and cities from all over the country were assembled in Washington and were told by Harry Hopkins, and later in

the afternoon by the President, of the dire necessity of submitting immediately projects, sponsored by political sub-divisions of the country, to the CWA. The watchword was "get men to work." The states, counties, cities and villages responded, and literally swamped the CWA with projects. Because of the lack of time for preparation, many of the original projects were not of great value, giving rise to the accusation of "leaf-raking." As the program continued, more and more worthwhile projects were submitted, until eventually, perhaps, 60 percent were excellent, 25 percent good, 10 percent fair, and 5 percent bad—and before the end of the year 1933, men were working. But the unjust "leaf-raking" stigma continued to cling to the program because of the refusal of critics to admit it had improved.

How long was this program to be continued? Until the work in the so-called "durable goods industry," under the stimulation of the PWA program, could take up the slack. It took the war to take up the slack.

Answering the Indictments

Now to answer the indictments: (1) Manpower was wasted and money was wasted. Webster devotes many finely printed lines to WASTE —"To spend or expend needlessly, carelessly or without valuable result; to consume or employ prodigally, idly or without any considerable return or effect; to apply to useless ends; to squander." Was it needless to put men to work? Ten million men answer "no." Was it careless to provide hundreds of thousands of useful public utilities and facilties and provide millions of men with wages? The answer is no. Was there no considerable return or effect or valuable result? Are not the following examples of "considerable return or effect" and "valuable result"?

LaGuardia air terminal and hundreds of others throughout every state in the union; Mississippi River flood control work; streets paved and repaired; water and sewerage systems installed, repaired, or extended; recreation fields and breathing areas provided; schools built, repaired, or enlarged; stadiums built; highways built, widened, and otherwise improved.

Are these useless ends? Was the money squandered? No. Certainly not.

(2) Self-respect was lowered through unlimited funds which concentrated power over men in adversity. During the early thirties, although I had no connection with any of the governmental agencies, through my several activities I had the opportunity of being in direct contact with men in a large area whose spirits were definitely broken and self-respect lowered, because all they asked was work—any kind of work—in line with their ability and skill if possible, but, if not, with a shovel or a broom. I met hundreds of professional men, as well as thousands of skilled and unskilled workmen, and there is not one I know who didn't welcome WPA. Yes, they embraced it, and none felt degraded or had his self-respect lowered. To the professional men particularly, it meant the right to walk among their fellowmen with their heads high because they were doing work they were specially trained to do and were not reduced to the status of beggars, which would have been the case if they had had to accept a dole.

(3) Engineering and the art of construction were degraded to the point of destroying manpower and abilities. The period starting 1940 proves WPA not guilty on this count, because never in the history of engineering and the art of construction have their manpower and abilities accomplished so much in such a short time. Rather than being destroyed, they were developed.

(4) It made a travesty of the definition of the engineer and construction man as an individual who can do well with a dollar what any bungler can do with two after a fashion. This is a very inspiring definition, but it doesn't go far enough and tell us where to secure the essential dollar.

(5) It contained no kernel of permanent cure for unemployment. One of the failings of all humans is the tendency to destructive criticism. Admitted, WPA did not contain the kernel. The criticism should not only point out the faults but should indicate a better method, a better formula, a better technique. Every conceivable plan was tried; all the letters of the alphabet were used in all combinations to find the kernel, but only WPA had the answer—put men to work. The global war seems to contain the serum with which you can give unemployment a shot in the arm and permanently cure it, but surely no democracy can advocate slaughtering the youth of the country as the elusive kernel of permanent cure for unemployment.

(6) It turned sickness into a chronic disease. Wrong again. The world was sick and WPA was one of the doctors. In its broad sense, chronic means continuous. WPA has ceased so it can not be chronic.

We should now develop a program of necessary public projects, carefully considered and professionally planned, to put employable men to work when and if the need occurs. As a backlog, let us be prepared to organize another WPA, planning now to correct any deficiencies which may have developed during the ten years CWA, ERA, and PWA operated.

To sum up: You can not indict a nation but you can indict individuals and groups, so let us be big enough to take the blame for the established fact that no one had the vision in the prosperous twenties to see the problem and find the answer. Let all of us—professional engineers, architects, bankers, lawyers, doctors, labor leaders, and editors—be frank enough to admit we could not measure up to our jobs, and through lack of foresight, lack of planning, lack of concentrated effort, lack of spirit, we brought upon this country one of the darkest periods in its history. Don't condemn WPA, but give it full credit for the great good it did and, in all fairness, hold the invective. Let us pray that never will this country be again faced with such agony of body and travail of soul.

HUGH A. KELLY, LT. COL., C. E.,
Kelly-Syska & Hennessy, Engineers, New York City.

Intracostal Canal

Sir: Referring to the article "Texas Pipe Line Transplanted in Florida," *ENR* May 20, 1943, p. 759, the statement that the Intracoastal Canal is from Houston to Carrabelle, Florida, is misleading. The western terminus of the Intracoastal Canal is Corpus Christi, Texas, in the heart of the Southwest Texas oil fields. Oil is moving regularly by barge from this Port eastward via the Intracoastal Canal.

DUANE ORR,
Assistant Engineer
Port of Corpus Christi, Texas

EDITORIALS

VOLUME 131 NUMBER 1

July 1, 1943

No Bargains In Engineering

DERBY, CONNECTICUT, apparently is looking for bargain rates in connection with engineering services if we are to judge on the basis of a notice appearing in the *Construction Reports* of the June 17 issue of this journal. There it is stated that the mayor will receive "competitive plans from engineers for a sewage disposal plant." Such procedure, of course, proposes a flagrant violation of the professional ethics. Simply stated, engineers do not compete on a price basis. The service they render and their selection to provide this service must be predicated on their professional abilities and special qualification as judged by the client. The basis of choice, therefore, is not price, and so-called "competitions" for design and supervisory services probably will elicit no response from reputable engineers. It is hoped that the Derby municipal officials will recognize the wisdom of conforming to established professional procedure that has been promulgated as a safeguard to both clients and their agents.

Picture of the Year

OUTSTANDING among the technical motion pictures now being shown at meetings of engineers is *Oil For War*, a dramatization of the Big Inch pipeline construction. Filmed in color and accompanied with a sound truck that provides a running account of the operations, this picture gives an unusual opportunity to witness the various steps in the construction of this spectacular project. In fact, the excellent camera shots of detailed operations and the carefully arranged sequences furnish more information than could possibly be gained in a field inspection trip, even under the most favorable conditions. Aside from its merits as a medium of education, however, the picture is a dramatic and inspiring document on the work of the construction industry. And every man, women and child—regardless of his background, interests or age—who sees this picture will ever after have a more appreciative understanding of the industry. In this respect, *Oil For War* can be one of the most effective instrumentalities for the furtherance of sound public relations. Our congratulations go to the Barrett Division of the Allied Chemical and Dye Corporation for making this cinema production available. If we were on a committee of awards, *Oil For War* would get the vote for the best technical "picture of the year".

Flame Straightening

CHARACTERISTIC of "growing pains" common to all new processes, the technique of flame straightening of warped and buckled plates and shapes has undergone an almost complete change of procedure in the past two or three years. Controlled bending has been necessary on a scale without precedent in fabrication and fairing of ship parts. An authoritative article in this issue, from a source close to both field and laboratory developments, describes the best of current practice in preventing distortion of steel being processed and in straightening or bending plates and shapes.

No Inhibitions

THE STORY comes from a Navy outpost of a destroyer whose fore peak was smashed and bent in operations near a rocky shore. The vessel limped back to a Seabees base where construction landlubbers used a crawler tractor to straighten the bow; cut some plates from scrap at hand and put a few angles on the outside of the forward section to hold the craft together. Repairs required less than a day and the destroyer made 17 knots to an established base. Probably the unconventional methods of the construction men may have proved to be a shock to the shipbuilders at the base, but the initiative of the Seabees kept the destroyer from being out of action for a long time, which is what counts most in war.

Bombs and Local Initiative

AT A TIME LIKE THIS, when virtually our every action is pre-ordained by directives from Washington, it is not unnatural to lose perspective concerning local responsibility. Such an attitude is particularly unfortunate in regard to civilian defense preparations. When and if bombs strike our cities, the manner in which a particular area conducts itself in such an emergency is a purely local—yes, even personal—responsibility, for which no set of rules can be devised beforehand. The importance of local initiative and action when bombing occurs was stressed by Arthur Collins, British municipal officer, who addressed the Ameri-

can Water Works Association conference a few days ago. Painting a graphic—and terrible—word picture of conditions in an area following an attack, Mr. Collins emphasized this: In the midst of catastrophe you cannot take time out to ask for instructions from some higher authority, or guide your actions according to legal statute—you must act quickly on the basis of past training and personal judgment to provide the most effective aid. American municipalities can draw these lessons from Mr. Collins' remarks: Don't expect a telegram from Washington, your state capital, or some political leader outlining what to do when bombs begin to fall; and prepare your civilian defense forces by training and practice so that they can intelligently display personal initiative in coping with emergencies. Even if bombs never fall, the experience of preparing to think and act for yourself should be a wonderful escape from war regimentation.

Earthquakes and Postwar Plans

WHEN ABEL WOLMAN, retiring president of the American Water Works Association, made the pronouncement that "barring some geologic cataclysm, there will be a postwar period" (*ENR* June 24, 1943, p. 25), he thereby provided two classifications in which engineers and public works officials can be grouped: (1) those who are laying their bets on earthquakes sweeping over the country at the war's end; and (2) a more optimistic type that is willing to take a chance and do some thinking for the future.

Judging from the apathy of many toward postwar planning, the "earthquake-believers" are in the majority. They take refuge in the argument that you cannot plan now if you don't know what to plan for. Yet, as Mr. Wolman so clearly emphasized, the process of thinking ahead is not unorthodox or a procedure that is foreign to engineers. For example, it is common practice in the waterworks field to think and plan improvements for ten, or even twenty years in advance. Therefore, to take a negative attitude toward postwar planning—which is just another form of thinking ahead—is contrary to one of elementary precepts of engineering.

Lack of action on the part of municipalities in preparing for the postwar period quite clearly reflects an attitude that "Washington" should and will take care of such things. This is wishful thinking and pure evasion of local responsibility. And it should be evident to those who believe otherwise that no federal agency can be endowed with the occult power to plan a public works program that will include provisions broad enough to properly serve the specific, local needs of every area. Past experiences and the more recent federal regimentation imposed by war give eloquent testimony that centralized planning can create more evil than good.

All of which adds up to a plea for realism and an aggressive display of local initiative. Forget the earthquake possibilities, forget Washington and decide now to assume some personal responsibility for the big task ahead.

Wartime Engineering Training

AFTER A HALF-CENTURY of concerted effort in upgrading engineering education to the enviable high standards which it now enjoys, our educators are being called on to perform a tremendous task in quickly and intensively training the thousands of servicemen elected by the Army and Navy for specialist work. This was the keynote theme prevailing throughout the recent 50th annual meeting of the Society for the Promotion of Engineering Education. Conspicuously lacking was any exuberant celebration attendant upon this golden anniversary; instead a most sober attitude existed. Army and Navy officials expressed the urgent need to secure for their men the best wartime engineering training in the least possible time; the engineering educators put themselves on record as anxious to cooperate to the fullest extent, despite the drastic changes that are called for.

Requirements of the Naval and Army specialized training have been established and so must be accepted—the Naval program as reasonably satisfactory, but the Army technical courses as still presenting many unsolved problems. Solution of these problems connected with training methods and procedures must and will be quickly found, for the war will not wait while a perfect plan is worked out. The educators part in meeting this challenge may not be a spectacular one, but it still will be an important contribution to winning the war. Their task would be greatly simplified if the Army would put an end to the uncertainties that have hampered them in recent months.

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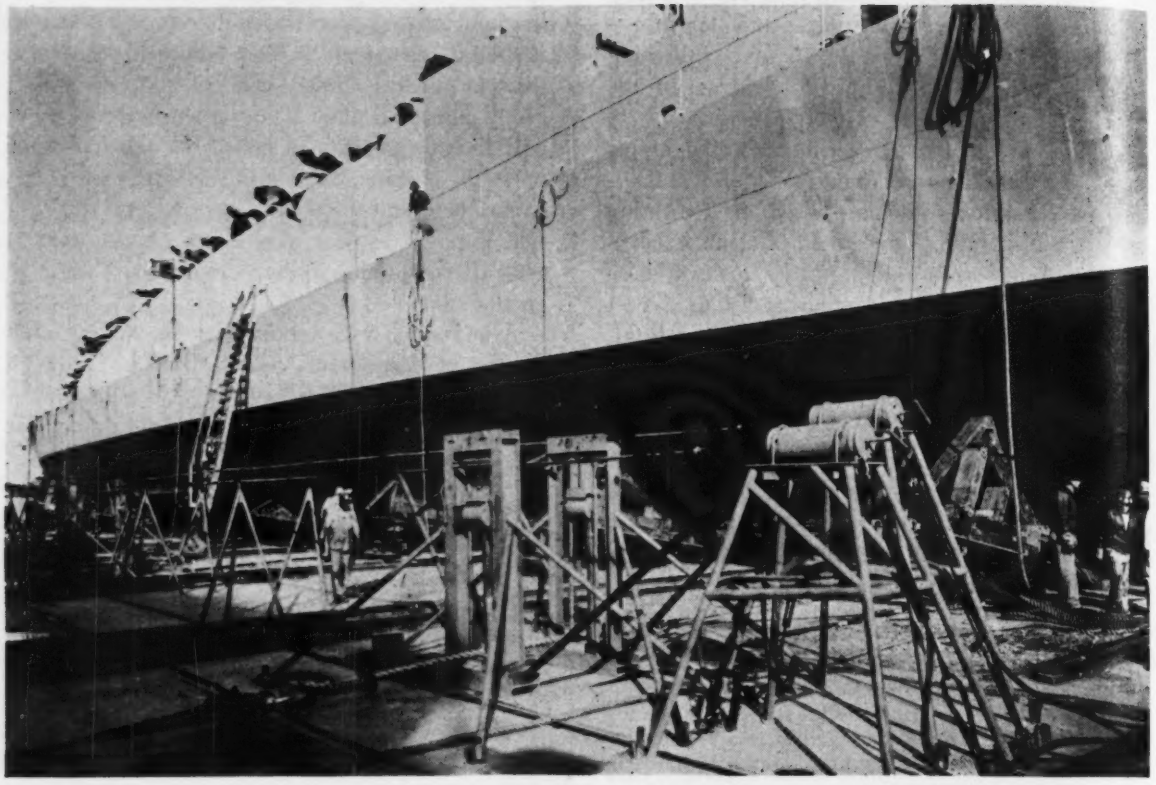


Fig. 1. Double guillotines are set to cut sisal rope lines to side launch destroyer escort vessels for the Navy.

Construction Men Build Fighting Ships

***Contents in Brief**—Destroyer escort vessels for the Navy are being rapidly built and side-launched by men, from supervisors down, whose usual work is heavy construction. Large portions of the ship are preassembled on platens built up of welded sections securely positioned by welding to rails embedded in a concrete floor. Hydraulic-powered cradles lift the ships for moving and transfer to launching ways.*

AN ORGANIZATION that usually handles heavy construction work designed and constructed the facilities for producing destroyer escort vessels for the Navy, then successfully took over building the ships. Doing a dollar volume of work every week comparable to the cost of construction of a major dam; they are building a fighting craft, capable of accompanying convoys on extended voyages.

Construction facilities and ship production were planned simultaneously by the same organization to take best possible advantage of the area available. The shipyard lies on a horseshoe bend of a bayou immediately adjacent to a deep-water ship channel. The horseshoe shape gave an excellent opportunity for layout of all operations around a central point, the fabricating and storage areas being made the center.

Side-launching ways are used in this yard because of limited launching space on the narrow bayou and because experience on smaller ships built in an adjacent yard had shown this method to be practicable and feasible. The ways now built are on one side of the horseshoe with an outfitting dock extending around the curved side of the area. Space is reserved for additional ways on the opposite side in an area now used for parking.

It was necessary to move more than 600,000 cu.yd. of earth to level up the yard, but fortunately a high area on one side provided suitable fill for a low section so that neither borrow nor spoil were necessary, though shell was hauled in for surfacing. A one percent slope each way to the outer edges of the horseshoe drains the yard and provides a natural slope that assists the movement of hulls to successive ways. Piles were required for the support of all heavy loads, including the ways, crane and transfer tracks.

Yard facilities

The yard is laid out for both road and rail haul to every part of the plant. Road hauling is done on trucks and on flat-bed trailers of about ten-ton capacity drawn by rubber-tired tractors. Rail-cars are used

for moving heavy units. Material enters the yard through a storage area and moves direct to the fabricating shop or warehouse as may be desired. Manufactured equipment for the ships may be delivered by rail directly to the outfitting dock or to nearby storage.

Full revolving cranes on high gantries, with a capacity of 40 tons at 25-ft. radius, serve the building ways and assembly operations. Railroad cranes move on rails around the warehouse area and outfitting dock, while truck mounted cranes are available for special work.

All buildings at the yard have the same span, 62½ ft., so that overhead cranes may be interchanged if breakdown or planned changes in loads make this desirable. The fabricating shop has four such bays transversely and one across its end longitudinally. One or more overhead cranes, of varying capacity, span each bay and are arranged to travel out over a section of the storage yard to unload cars, carry plates and shapes to the machines. Several jib cranes, with power hoists, service particular operations. The machine, pipe and sheet metal shops are well equipped to handle all work required on the ships and any repairs that may be necessary.

There are two side-launching ways at the yard, also used as assembly ways, and three building ways in a bank inshore at each launching way. As a ship is completed and launched the ships on the inboard ways are advanced to a new position and new keels are laid on the ways made vacant by the transfer.

Light plate and shapes used

The ships being built use relatively light plate and shapes, all structural parts being fabricated at the site. Welding is used almost exclusively, only 200 rivets going into a ship. Multiple production is planned for the units required and several are fabricated at one time, being marked and stored until needed. Storage bins and racks for completed sections are placed near areas where the parts will be used. Small parts are subassembled on special jigs in the hull shop.

Platens or platforms for assembly of large sections are located between the two banks of ways and at their ends as space permits. Platens are 43 ft. wide to accommodate the destroyer-escort assemblies and are very lightly reinforced, 6½-in. thick concrete slabs laid on the ground.

An innovation in platen construction is old rail embedded upside down in the concrete with the base flush with the surface. These rails are used as a base for assembly jigs providing an unyielding support to which frames can be welded. Special, permanent jigs are used for each main assembly rigidly built-up to the shape of the piece to be assembled and equipped with adjustable lugs to hold the steel to exact position. Parts for all the ships are made on one jig by one crew. Smooth lines of the finished hull and uniform plating with little stress result from the methods followed. Completed sections are handled by gantry cranes, which move them direct to the vessels or to temporary storage as required.

Rolling sheds, built in sections 42 ft. wide (to straddle the platens) and 48 ft. long, are used to protect the work from the elements. They are light in weight, made of pipe-tubing rejects and are open all around. About 75 percent of the length of each platen is covered, the sheds being moved longitudinally on rail in the platen floor to permit shifting of

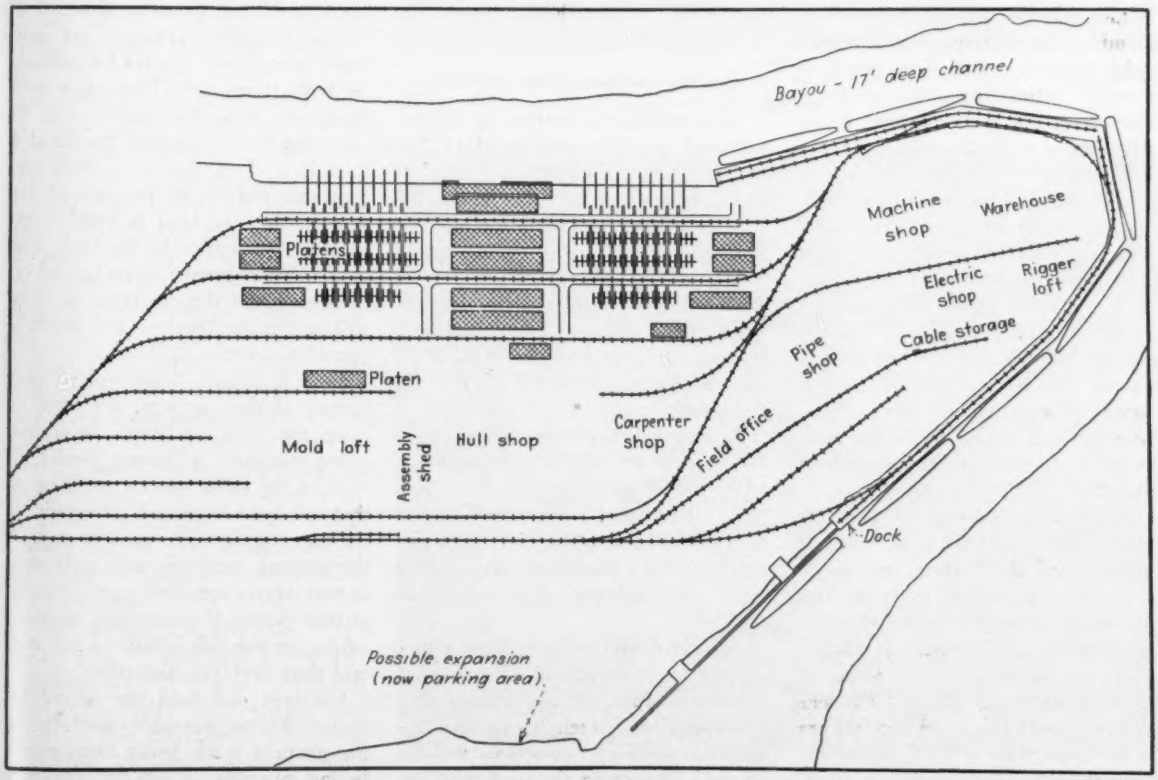


Fig. 2. Yard is laid out around a horseshoe bend on a bayou with sufficient room for construction of additional ways.

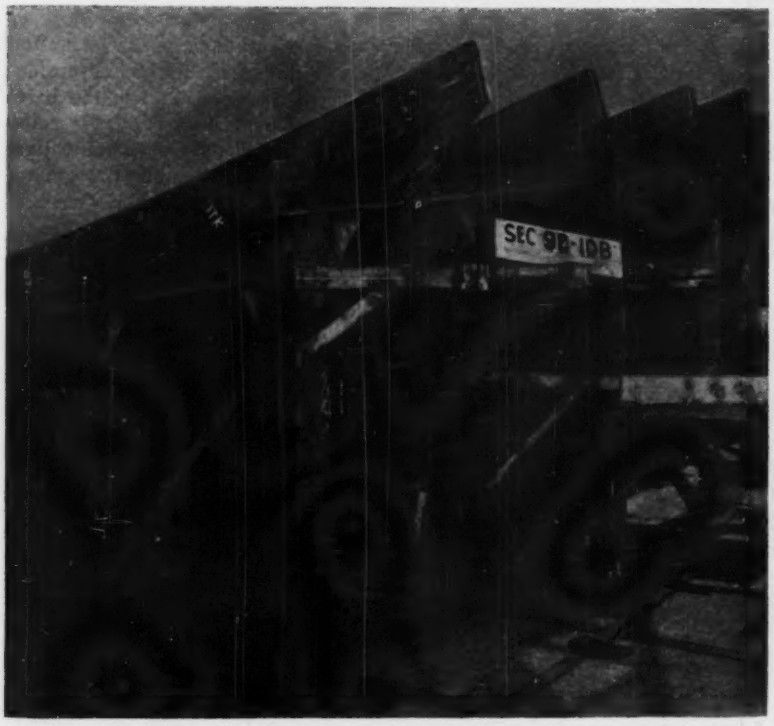


Fig. 3. Railroad rail embedded upside down in the concrete base hold assembly platens rigid.

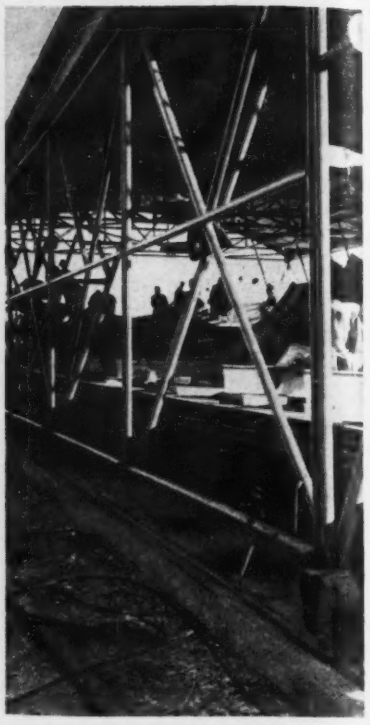


Fig. 4. Rolling sheds, made of pipe-rejects, protect platens from weather.

the work. The sheds assure better working conditions, resulting in more production.

The entire forepeak of the vessel is assembled separately, being turned upside down for part of the work to expedite fitting up and welding. When complete it is attached to an adjoining section, the two having a total weight of 30 tons, when ready to be set in place on the building way for welding to the rest of the hull.

The stern section also is completed on the platen and moved to the building way in one piece. Deck houses are made into one 25-ton unit for setting while the ship is in final position on the ways. Assemblies are swung to approximate position by the crane and pulled to closure with the aid of turnbuckles and steamboat ratchets.

The building ways are of concrete rather than steel, using a figure H support with the bottom and bilges of the ship posted-up from the two legs of the H and the keel resting on the cross-member. Posts are timber shores set under a short piece of angle welded to the plating. The legs of the concrete H-shaped support are 14 ft. apart with a 13-ft. space between them to accommodate a transfer car for movement of the hull along the ways. Longitudinally, the ways are 55 ft. apart, except where space is provided for operation of the gantry cranes; then they are 94 ft.

Assembly procedure on the ways

Ship assembly is started by laying prepared midship hull sections on the way farthest inboard. This way is not full length as bow and stern assemblies are not placed at this position and platens occupy the space saved. Hulls are moved riverward on the ways as launching makes forward positions available. Hanging falsework is attached to the hull in the first position and left on it until the vessel is ready for launching.

Preassembled sections are added to the ships at any of the building ways with no definite requirement that parts be added at a particular station along the assembly line. Single cranes usually handle the largest sections and can set them wherever desired.

Present operation is to launch two vessels from one bank of ways on successive days, or the second day following, and then move the remaining units up two spaces instead of one. This saves the work and delay of one move on the units on Ways 3 and 4 and has been found more expeditious than moving the units one space at a time. Two new keels are then laid at the same time.

Nine transfer carriages are provided at each set of ways for moving the hulls riverward. They are a steel frame on wide flat wheels, Fig. 6, operating in two channel tracks at 4 ft. c. to c. Two cradles on each carriage, shaped to the contour of the ship so that the load is evenly supported, are fitted under the keel. The cradles are arranged to be turned on their sides on the carriages so they will pass under the hull and are then turned up to take the load.

Four hydraulic jacks, one at each corner of the carriage, are used to raise the load. A single hydraulic pump supplies a lifting power to each of the jacks on one carriage so that the load is picked up evenly at the two cradles. The crew at each of the several carriages are instructed to maintain a specified gage pressure at their pump, thus assuring uniform lifting of the full length of the hull and thus avoiding distortion.

Carriage and load are moved by tugger hoists, movable sections of the channel track being temporarily bolted into place across the craneway to permit passage. Uniform pull

from the tuggers is secured by bringing each line up snug then starting all machines simultaneously. It requires about one hour to prepare the carriage for movement of a hull and six to ten minutes for the actual move.

Launching ways are used as a building way for some of the final assembly with the ship supported largely on posts resting on the transfer cradle supports. Transfer carriages are used under this hull during the period just prior to launching in order to shift the support for painting and for final preparation of the cradles and ways for launching. The hydraulic lifting device on the carriage is used to lower the ships to the cradles, none of the usual long wedges being used.

Weight of the ship at launching is about 650 tons, but this is gradually increasing as more of the permanent parts of the ships are made available during the early construction stages.

Ten cradles used for launching

Ten cradles are being used to launch the ships, all of them built of timber and framed so that they support the ship for three-fourths of the width between bilge-keels. The cradles are built of pine with the sliding members being two pieces of 10x10-in. fir, most of them 29½ ft. long. "Snaplines" to the deck hold the cradle tightly under the ship as it slides down the ways.

Ground ways are a pair of 12x12-in. creosoted timbers on a 2:12-in. slope extending to about the water surface. They are supported on creosoted piles, part of which are battered to resist forces in either direction. The ground ways are plated with 2-in. oak and have high melting-point grease heated and poured on them. An hour before launching a sliding coat of soft grease is placed over the hard grease and under the cradle so that sliding friction is reduced to a minimum. Ways are kept covered until a few minutes before launching to keep grit and dirt out of the grease.

Back 35 ft. from the ends of the ways a line of Wakefield piling parallels the water's edge to hold the bank from sliding or washing. On the water side the ground slopes rapidly down to a channel depth of 17 ft. The ships draw only 4 or 5 ft. of water at launching stage but the cradles dip to about 14 ft. below the surface as the ship slides into the water.

Ready for the splash

A few hours before launching time the transfer cars are moved back from the shop to be launched into position under the next hulls. At this time all the load of the ship is on the cradles and they are blocked at the front end by positive stops across the ground ways to prevent moving. The trigger arrangement, showing in Fig. 7 is used at four positions with 10x10-in. short struts from the trigger to the cradles. The triggers are held by a safety line of wire rope with a roller chain hoist for tightening up the rig to hold the blocks in

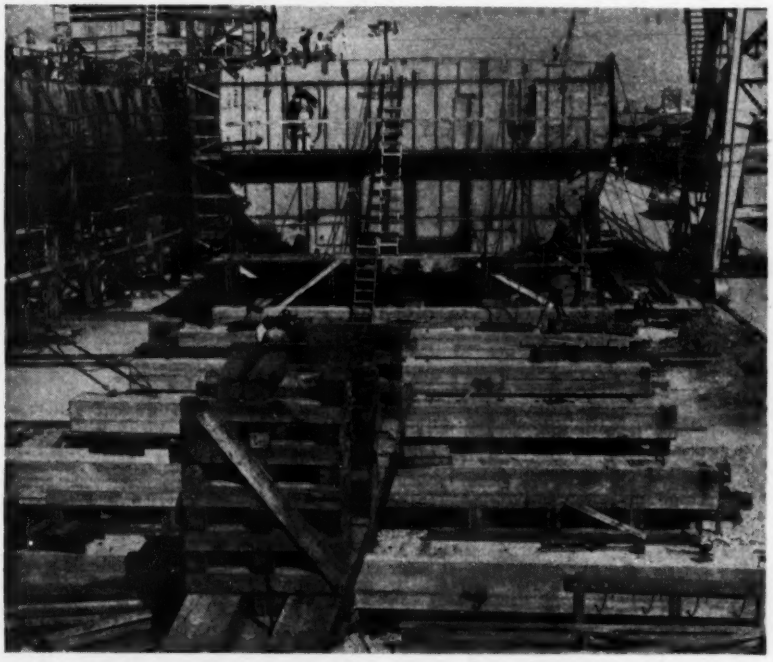


Fig. 5. Shipbuilding ways are of concrete on creosoted wood piles. Timber in the foreground is built up to support the high stern

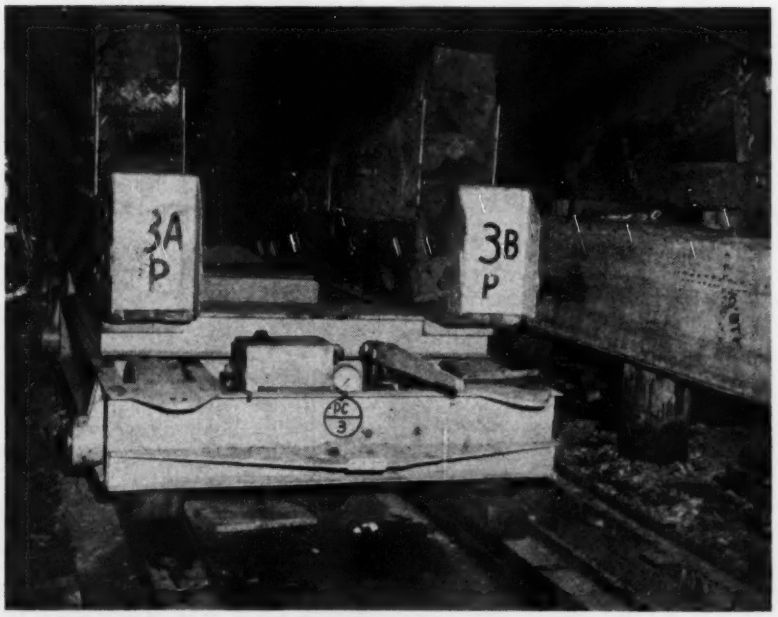


Fig. 6. Transfer carriage has four hydraulic pistons connected to one pump to lift the ship for movement ahead.

place. Also in position is a wire rope line to a sisal rope launching line. Each sisal line is carried through two rope-cutting guillotines to a chain block.

Long coil springs are put in tension to simultaneously snap all of the triggers open as soon as sisal launching line is cut and cradles are free to move. Coil springs are also attached to the short post blocking, Fig. 7, to the launching cradle to jerk them clear of any possibility of fouling as soon as the load is released. Tension in all of the springs is made approximately uniform by the same crew setting all of them, gaging by the manual pull the same men are able to make.

How guillotines operate

Four pairs of guillotines are set in two lines with each worked by an air actuated ram that moves a long rod releasing the weighted knife so that it falls on the rope. The second set of guillotines is a 100 percent safety factor while axe men stand by at launching time for a possible emergency. To assume that both ends of the ship start to move simultaneously an air ram, connected to the same air valve as the guillotines, pushes a wedge across the upper ends of the two outer cradles to start the ship on its way.

Launching ceremonies are scheduled for 15 min. period. At 8 min. before the end of the ceremonies the load on the holding line is transferred to the sisal rope line from the triggers by taking up on the chain blocks. This "breaks" the grease under the cradles and gives an opportunity to remove the safety blocking in front. The superintendent and the launching foreman each personally examine each of the several cradle supports, then as the champagne splashes, the signal is given for opening the air valve, actuating the guillotine knives, cutting the ropes and starting the ship by action of the wedges at the end cradles .

The ship goes into the water on almost an even keel, listing less than 10 deg. Total travel of the ship sideways is 78 ft. down the ways and about the same distance in the water. Movement of the ship is quickly snubbed after it hits the water by "snap-lines," $\frac{3}{4}$-in. dia. sisal rope attached at intervals to a 2-in. dia. line and expected to break, but helping to slow the movement without a serious jerk. Four such snap-lines are used on each one of the four holding lines.

Preparations are immediately made to move another ship into the launching position. The guillotine set up must be completely removed as it blocks the gantry track and riverward movement of the next hull. More time than is necessary for preparation is deliberately assigned to the moving operation and readying the ship for launching to make sure that nothing is rushed or missed. When a second ship is ready to be launched from the same way it usually is scheduled for the second day following.

A tug moves the newly launched ship to an outfitting dock that extends around the bend and one side of the horseshoe providing single berthing space for seven ships. The dock is wide and accommodates rail delivery and railroad crane service. A narrow extension of the dock accommodates two more vessels, but the only access here is by truck or truck crane at a midship point.

The ships progress around the dock as shipfitting and installation of machinery and equipment continues. Ships move forward as work is completed in a modified assembly line plan with definite operations scheduled for completion at each of the several stops. Little can be said about the vessels being constructed in the yard, or their outfitting, due to security regulations.

Personnel

Work started on the yard in the spring of 1942 after most experienced shipbuilders were employed elsewhere. Consequently less than 5 percent of the employees have had as much as one year's experience in shipbuilding.

After exhausting the supply of available supervisory forces with shipbuilding experience a number of the key positions had to be filled from the contractor's construction organization. This includes engineers, top supervisors and foremen, as well as experienced riggers, machine operators, electricians, machinists and other craftsmen who normally build dams and powerhouses. The organization has been

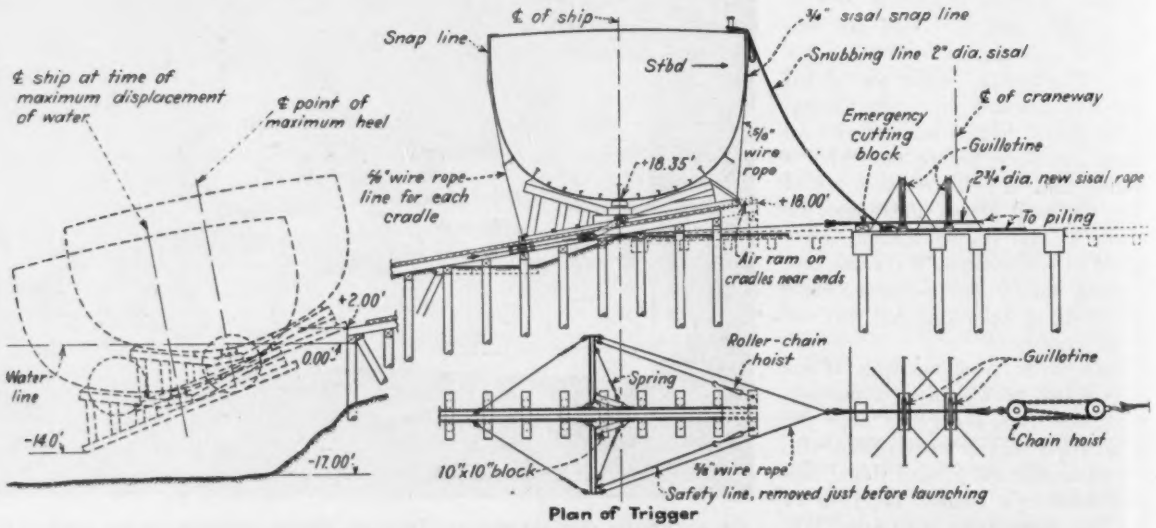


Fig. 7. Details showing arrangement of cradles, ways and trigger assemblies used in side launching of vessels.

Fig. 8. Ready for launching, the vessel rests on ten cradles that will slide on greased ways.

awarded an Army-Navy "E" for construction of facilities and ships.

About 20 percent of the employees in the yard are women and the percentage is increasing. They are employed as shipfitters, welders, burners, material checkers and electricians, in fact in almost all phases of the work. Many of them are on the assembly platens on the heavy construction and their work is satisfactory.

Contractor for design and construction of the facilities and building of ships is held by Brown Shipbuilding Company. Herman and George R. Brown of the construction firm of Brown and Root, Inc., are partners in the enterprise. L. T. Bolin, a vice president of Brown and Root, Inc., is general manager for the firm. J. E. Walters is works manager, M. P. Anderson is chief engineer and assistant works manager and T. L. Brown is general superintendent.

During construction of the yard and building of the first ships Captain Schelling, with offices at Orange, Texas was supervisor of shipbuilding and Lt. Comdr. M. I. Kearns was resident officer in charge at the Brown shipyard. Recently Captain D. C. Redgrave was made supervisor of shipbuilding at this project.

Minnesota Legislature Takes Steps To Aid Postwar Airport Planning

An indication of the probable trend in state and local airport development to follow after the war, when airport systems may be as important to transportation as highways, is contained in legislation recently enacted by the Minnesota state legislature (*ENR*, April 22, p. 241), as reported by the American Municipal Association. To prepare for postwar air transportation problems, the following steps were taken by the legislature:

1. Broadening of the state aeronautics code by incorporating the comprehensive airport zoning provisions of the model zoning act prepared by the Civil Aeronautics Administration.

2. Establishment of a public corporation, known as the Metropolitan Airport Commission, to develop airports for Minneapolis and St. Paul. An authorized appropriation of $25,000 will enable the commission to study existing airports in the Twin Cities and formulate plans for improvement and construction of new airports.

3. Extension of the provisions of the Metropolitan Airport Act to include the development and control of municipal airports in all parts of the state. Municipal airport development throughout the state will be augmented by a $1,000,000 state fund provided by taxes levied for that purpose over a 10-year period.

4. The legislature gave its initial approval to a constitutional amendment, to be submitted to the voters, authorizing the state to construct, improve, maintain and operate airports and to assist counties, towns, villages and public corporations in carrying on these airport activities.

The Twin Cities commission is directed by the legislature to take over operation and control of all airports owned by either city, and it may construct new airports "substantially equi-distant" from the two city halls but within 25 miles of them. The corporation, also, may issue up to $15,000,000 in bonds, with credit of the two municipalities pledged to their payment.

Fig. 1. Tunnel under construction at left for C. & O. Ry. will replace the existing tunnel built in 1850-1858.

C. & O. Replaces 1850 Blue Ridge Tunnel

***Contents in Brief**—Need for a larger tunnel to permit passage of more powerful engines and larger loads prompted construction of a 4,000-ft. tunnel through the Blue Ridge Mountains on the C. & O. Ry. It will replace a tunnel, largely unlined, started in 1850 and in service for 84 years.*

ONE OF THE FEW CIVIL PROJECTS being continued despite war curtailment is construction of a new single-track tunnel on the Chesapeake and Ohio Railway through the main ridge of the Blue Ridge Mountains. This project, at Afton, Va., replaces a similar tunnel, but of smaller bore, inadequate to pass modern locomotives or the largest freight loads. The C. & O. has some of the largest locomotives in the country, but hauling of heavy trains of war materials on this main link to Washington and the East has been seriously hampered by inability to use the big engines over the mountain division.

The project has been planned so that the use of new or critical material will be reduced to a minimum; most of the construction equipment came from other projects leaving only drill steel, repair parts and a moderate amount of gelatin explosives to be procured.

The original tunnel and three shorter ones nearby were started in 1850 on a 17-mi. extension from Mechums River westward to Waynesboro on what was then the Blue Ridge Railroad. Drilling was done by hand and it required eight years to complete the project. Earliest record of power-drilling in tunnels was on the Mont Cenis Tunnel through the Alps about 1861. The moving spirit of the project was Col. Claudius Grozet, chief engineer for the Commonwealth of Virginia, who had served as an artillery officer under Napoleon and as professor of engineering at West Point.

Excavation of the early tunnel was carried on from the two portals, considerable difficulty being encountered in faulty rock for the westerly third of its 4,264-ft. length. This section was lined with a brick arch, but the rest of the tunnel has remained unlined.

When it appeared that the balance of the line would be ready in 1854, four years ahead of the tunnel, a temporary winding track was laid over the mountain to permit operation of trains while tunneling was completed.

New construction is being done only to improve clearance as the grades and curves of the old line are no greater than for other parts of the same division of the railroad, for which there is no plan of immediate betterment. The old tunnel has a vertical clearance above rail of only a little more than 18 ft. and the new structure will have a clear height of 22 ft. above rail at car eaves with a lined width of 18 ft. Both are single track.

An alternative to construction of a new tunnel was enlargement of the existing bore. Due to the requirement of continuous operation for heavy freight and passenger traffic it

was estimated to be no more expensive, and probably less expensive, to drive an entirely new tunnel. In addition, the better grade and alignment will improve operating characteristics through this section.

The grade on the old tunnel is 1.25 percent ascending westward, and all of its length is straight except about 100 ft. at the east portal. However the curve just outside of the east portal has a maximum curvature of 13 deg. with a sweep of almost 90 deg.

The new bore is 4,000 ft. long and lies 150 ft. to 500 ft. to one side of the old tunnel. The easterly 1,300 ft. of the new tunnel, and a considerable track length outside, will lie on a 3¼ deg. curve with terminal spirals, while the remaining 2,700 ft. of tunnel will be on tangent except for about 100 ft. of light curve at the west portal. Grade throughout the work is 0.9 percent, compensated, ascending westward through and beyond the new tunnel. The east portal is 18 ft. lower than the old east portal and the new west portal will be about 30 ft. lower than the old one.

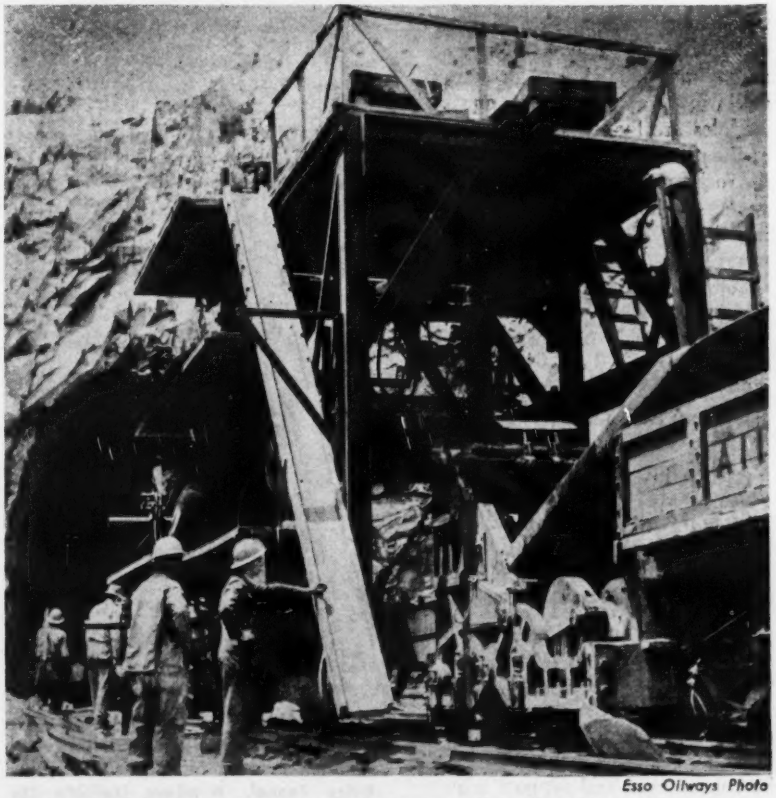
Project two miles long

The entire line revision extends for about two miles, including the new tunnel, with high side-hill fills east of the mountain. At the west portal the rock is mostly shale and not very hard. An approach cut 2,000 ft. long, with depths up to 102 ft. on center line of track, has been made. The shaley material shoots, digs and slides easily. The latter characteristic required careful preparation of backslopes and several benches in the required height to assure freedom from slides into the finished cut.

Excavation at the west approach, some 350,000 cu.yd., was loaded by power shovels on crawler treads. Part of excavated material was wasted by off-rail haulage to a spoil bank nearby, but much of it was loaded in 16, 20 and 30-cu.yd. air-actuated, standard gage side-dump cars. Track was laid on the rough grade, following the shovel cut in from the point of juncture of the realigned section. Most of the material hauled by rail was taken through the existing tunnel to make side-hill fills needed near the east end of the tunnel.

Excavation for the new bore is being done only from the east portal, for several reasons: (1) the comparatively small amount of east approach excavation permitted tunneling to start there long before completion of the west approach cut; (2) downhill haul for loaded cars and gravity drainage of water; (3) muck is needed for the east approach fills. By the time the west portal excavation was completed the bore driven from the east end was more than half-way through the mountain, so

Fig. 2. An approach cut 102 ft. deep was excavated at the west end of the tunnel.



Esso Oilways Photo

Fig. 4. Combined car-changer and jumbo, mounting 13 drills, used against a 26 x 20-ft. face.

that the saving in time possible by working two headings was not sufficient to warrant the expenditure for duplicate installations, even if equipment could have been obtained.

The tunnel is being excavated full face. It is about 26 ft. high by 20 ft. wide, with the height increased to 28 ft. and the width to 24 ft. where timber supports are required. A combination drill-carriage and car-changer on wide gage-track is used at the heading. This "jumbo" mounts 13 drifters used to drill 70 to 78 holes in the face for each round of shots. Holes are drilled 10 to 12 ft. deep, using 3, 5, 7, 9, 11 and 13-ft. lengths of steel. Bits are forged, the starting steel having a gage of 2½ in. and being reduced ⅛ in. per change to 1⅞ in. for the 13-ft. lengths.

The rock encountered varies somewhat. The east portal material is a type of Blue Ridge greenstone, though little of it is the extremely hard light-green material most characteristic of this rock. About midway of the tunnel is a broad band of granitoid material that is exceptionally hard to drill. Through most of the greenstone the drills generally made the 2-ft. depth without change, but in the hardest greenstone and the granitoid material a single drill-bit would ordinarily make only 4 to 9 in., while in exceptionally hard formation a steel would drill less than one inch.

Holes are loaded with about 5 lb. of 40 percent gelatin per cubic yard of rock, and the average shot advances the heading 8 to 10 ft., bringing down 150 to 200 cu. yds. The usual cycle is 4 hr. to drill, load and shoot; 5 hr. to muck and 1 hr. to scale loose rock, accounting for a round on each of the two 10-hr. shifts. Loading is done by a mucker delivering to 36-in. gage, 5-cu.yd. side-dump cars hauled by diesel locomotives. Storage battery locomotives are used for switching in the tunnel. Empty cars are lifted by an air hoist on the drill jumbo so that loaded ones may move out.

Very little water has been encountered in the tunnel. Rock generally has been solid and only a short section, totaling less than 10 percent of the length has required support. Experience on the previous tunnel and subsurface investigation on the new line indicates that poor rock will be encountered and support required for 250 ft. near the west portal. Heavy timber rings, made up of five 12x12-in. members, carried by timber wallplates and plumb-posts, are used where roof support is necessary.

All material from the east portal excavation and the tunnel mucking is dumped down a high side hill near the east approach to provide space for easing the horizontal curve necessary for tunnel entry, and for other filling incidental to the line revision nearby. The toe of the new fill lies as much as 150 ft. below track level.

Minimum of equipment

The contractor's plant for the work is not elaborate. Air is furnished by two 715-cu.ft. per min., one 700-cu. ft., one 500-cu.ft., and three 315-cu.ft. compressors, all being diesel-powered portables except the 700-cu.ft. one which is of stationary type. All are housed together near the east portal and air is piped into the tunnel through a 6-in. dia. line supplying air at 90 to 100 psi. at the jumbo.

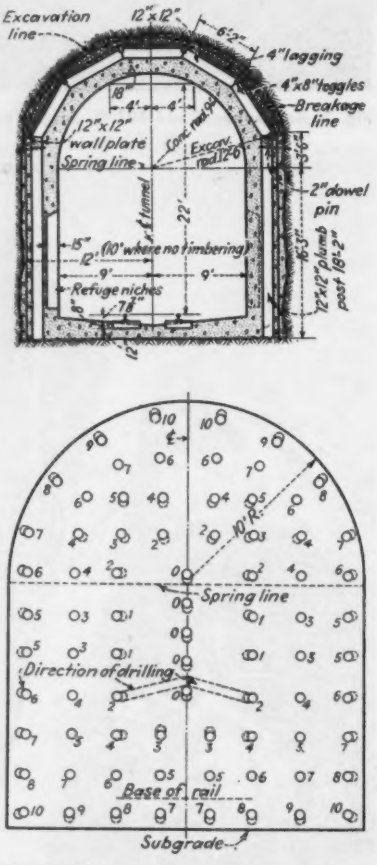


Fig. 3. (Above) Typical section of tunnel where timbering is required; and (below) pattern for drilling the Blue Ridge Tunnel. Numbers indicate the sequence of delayed explosions occurring over a 5 to 6 sec. interval.

Ventilation is provided by a 13,000-cfm. blower with the air carried to near the heading in a 26-in. dia. pipe. A 225-hp diesel engine with V-belt drive to a generator supplies power for lighting and operation of the mucker. Originally a 150-hp direct-connected gasoline engine driven unit with a 75-hp auxiliary connected by a V-belt drive to the same generator were used. These proved incapable of continuous operation and now serve as a standby.

Contrasting with the short section of brick lining in the old tunnel the new bore will be concrete lined throughout. It is expected that 25,000 cu.yd. of concrete will be placed, using wood forms. Concrete side ditches and the bottom course of the sidewalls will be placed in advance of the remaining sidewall and arch concreting. The main sidewall and arch forms will be carried on a timber traveler working toward the plant. A length of 60 ft. of form will be moved ahead and filled in a one-day cycle.

Equipment available for mixing concrete for the lining is a skid-mounted unit that will work in the tunnel and take dry batches from boxes set on the muck cars. Concrete will be discharged from the mixer to a pneumatic blower for placing. No grouting is contemplated outside the lining.

Construction of the project started in November of 1941 but tunneling did not get under way until May of 1942. The bore advanced an average of 300 ft. per month throughout the job with well over 400 ft. often gained at the one heading. Holing through is expected in July and completion of the project, including lining and laying of track is scheduled for November of this year.

The general construction contract is held by Bates and Rogers Construction Corp. of Chicago for whom R. A. Chermside is superintendent and James Strong, special construction consultant. The west approach work has been completed by the Asheville Contracting Co. of Asheville, N. C., under D. R. Agnew, superintendent.

For the Chesapeake & Ohio R. R., P. L. Graves is resident engineer on this and other work in the immediate area. E. G. Rice is district engineer at Clifton Forge, Va., and I. L. Pyle is chief engineer of the railroad with offices at Richmond, Va.

Oxyacetylene Flame Straightening

LaMotte Grover
Structural Welding Engineer, Air Reduction Sales Co., New York, N. Y.

***Contents in Brief**—Plates or structural shapes can be straightened or bent by application of an oxyacetylene flame but efficiency in the operation comes only from "know-how". The author gives here the necessary information for successful manipulation of steel by flame treatment and describes the equipment needed and special tools available.*

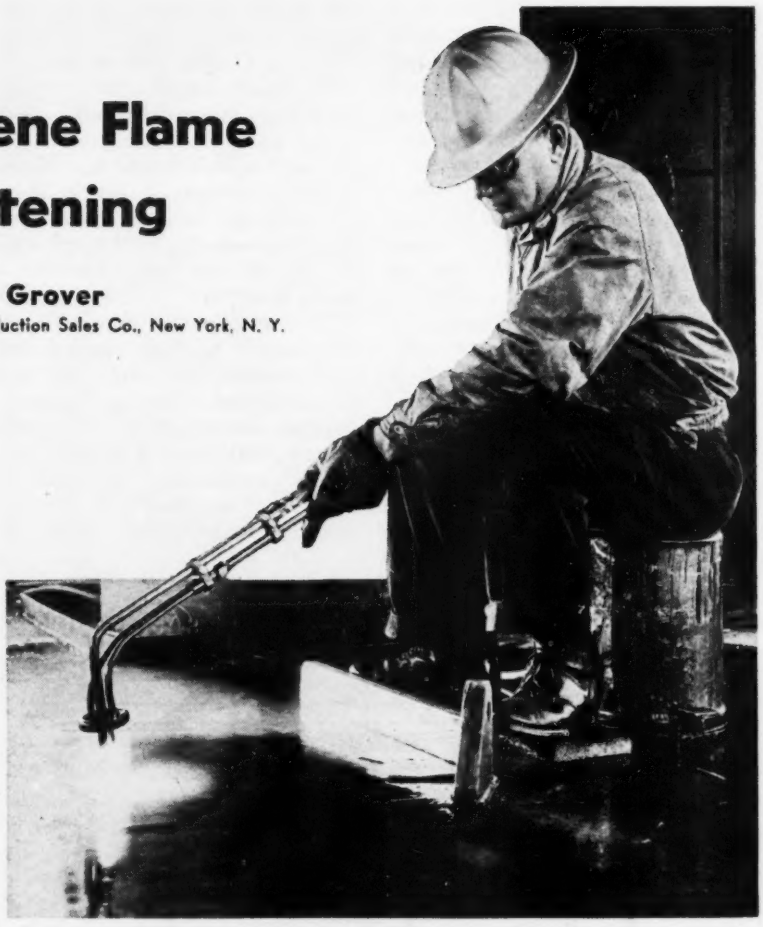


Fig. 1. Water-quench ring, with water spray around the outside of the flame to keep the heat localized, is useful in spot-heating for straightening plates.

FLAME STRAIGHTENING, an oxyacetylene process for removing warps and buckles from plating, and for straightening bent structural members, is a procedure which is widely applied, but, possibly because it is not always thoroughly understood by the user, these applications sometimes achieve less than maximum attainable efficiency.

Essentially a very simple process, flame straightening involves merely the judicious application of heat. It is not a "heat treatment" of steel within the metallurgical meaning, because the heat is applied only for its expansive effect, to temporarily soften the metal locally so that upsetting may take place.

Each of the various procedures commonly used to correct distortion in plating and in structural members, with the aid of an oxyacetylene torch, in reality seems to involve one or more of four rather distinct physical operations:

1. Highly localized stress relieving; accomplished by a rapid, narrow heating of the weld zone to a comparatively low temperature (not sufficient to cause appreciable upsetting). For this operation, slow cooling seems better than the rapid cooling that is effected by the use of some kind of a quench.

2. Hot bending; simply what the term implies, usually carried out with the aid of jacks or maul and flatter. This operation is used to help remove sharp knuckles in plating or sharp bends in structural members.

3. Flame straightening, in the sense that it has been defined in the second paragraph; essentially an upsetting process which depends entirely upon the inherent stiffness of the metal surrounding the heated area, to furnish the reactions required to cause upsetting as the heated area tends to expand. (Fig. 2-b).

4. Flame straightening with the aid of external force to furnish reactions that help the upsetting action. An example of this operation (Fig. 2-a) is the placing of a strain against a buckle in a plate, by means of a jack, so that the force exerted will be transformed, through a toggle-like action, into reactions in the plane of the plating.

For maximum efficiency the practice of flame straightening calls for a degree of skill and understanding not unlike that of the consulting engineer who, when called upon to discover what was mysteriously disrupting an intricate mechanical setup, gazed thoughtfully upon the installation and then put everything to rights simply by seizing a hammer and tapping upon a pipe. Later, when the client complained that the consultant's bill for $250 seemed excessive, the engineer sent an itemized bill: for tapping with hammer $2; for knowing where to tap $248. And in a sense, so it is with flame straightening. The heats themselves are easy enough to make, but the success of the operation depends upon applying the right amount of heat in the right places.

Primarily the technique is to apply concentrated heat at a very rapid rate of input to produce a powerful local expansion. This results in an upsetting of the hot spot, surrounded as it is by rigid, colder metal. Upon

cooling or quenching, the hot spot contracts in at least one direction, to a length less than its original length. This controlled shrinking can be used to take up slack in buckled plating, to straighten bent members, or to impart a bend as desired.

Rapid heating is necessary because slower heating would permit conduction to soften adjacent metal somewhat and, instead of effecting the necessary upsetting, would tend to cause merely an expansion, often producing a large welt or a warp. To accomplish desired results, it is not necessary, nor generally desirable, to heat the steel to a point where it shows appreciable color. By holding the heat at or just below a cherry red, there should be no hardening or undesirable effects on ordinary carbon steels, even when a water-spray quench is used.

For very thick sections a somewhat higher temperature may be used and, when external force is employed to speed up the process, the steel may well be heated to a higher temperature than in simple flame straightening. In the latter case, quenching should be delayed until the heated area has cooled to a cherry red.

The extreme versatility of flame straightening methods, coupled with their inherent simplicity, make them of special time-saving significance in wartime, when perhaps 90 percent of such work is done on ship plating. If every buckled deck plate or warped bulkhead had to be straightened by external force alone, the extra cost and loss of time would be formidable.

Two rather distinct categories of flame straightening will be discussed —plate straightening and the straightening of structural members. Both are distinguished by the application of a concentrated heat to cause upsetting.

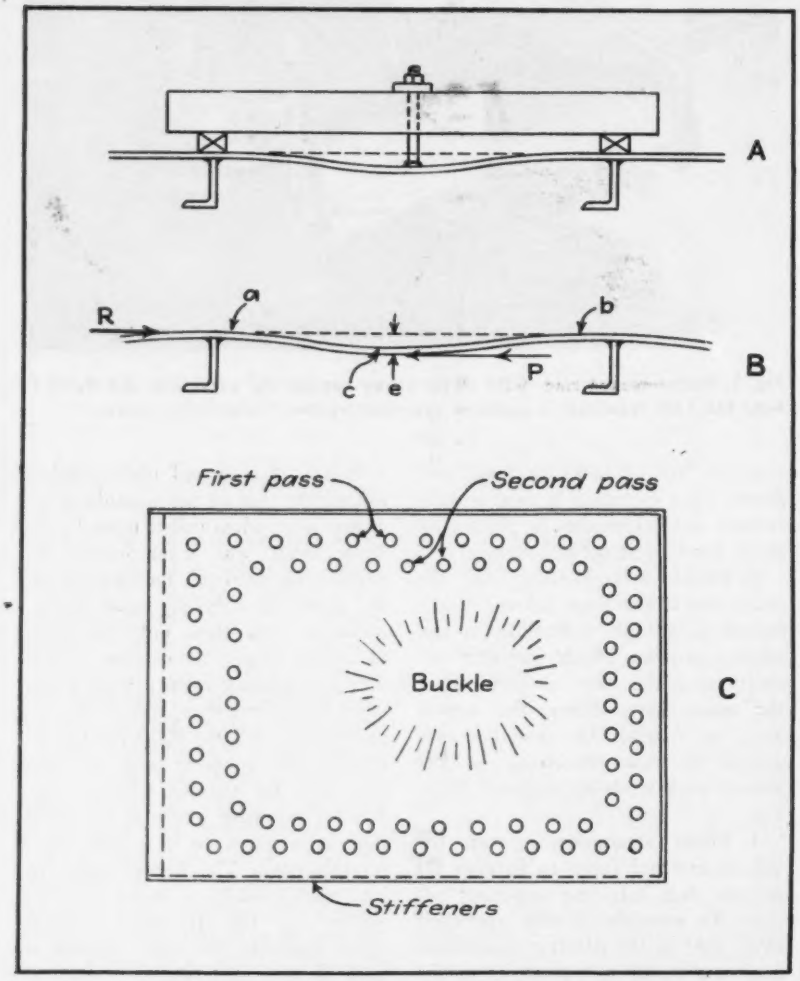


Fig. 2. (A) Strongback for isolated sharp buckle. (B) Heat applied at center of buckle, c, will not cause upsetting because of eccentricity e between expansion force P and resisting force R, and because c is too far from stiffener to be restrained from further buckling. Heat first at a and b in spots about the size of a 25-cent piece around the flanks of a buckle (as shown in C) to straighten a distorted plate.

Plate straightening technique

When buckles or bulges occur in plating, the most common method of correction is "spot" heating, although "line" heating is sometimes just as effective, especially in heavier plating. As shown in Fig. 2c, spot heating is accomplished by following a systematic course of heating and quenching, starting near the periphery of the buckle or around its edges and working in toward the high center. This is generally done by holding the torch steadily over a small spot about the size of a 25-cent piece or smaller until perceptible color just begins to appear, then following immediately with a spray quench, directed at the center of the heated spot.

The most common practice is to heat and straighten the smallest warps on the plate first, coming to the deep warps last, especially when the plate is unsupported around its boundaries. In the latter case it is often desirable to use a maul and flatter or jacks and strong-backs to do the work more efficiently. Quenching is advisable, since slow unquenched cooling results in some stretching out of the upset metal and consequent lessening of the effectiveness of the operation.

Warping caused by welding stiffeners to plating is commonly removed by heating a line along the surface opposite the stiffner welds, except in the case of thin plating, where spot heating seems more effective. In this application the heating may function more as a local stress relieving influence than as an upsetting operation. Line heating opposite beams or stiffeners should always be confined within narrow margins, and should be done as rapidly as possible to keep the heat localized. A lower temperature of heating is desirable here than in other straightening operations. Quenching, in this case, can well be omitted.

Thin plate is more difficult to straighten by line heating. Generally the most effective method to use here

is to heat two rows of spots, one on each side of the stiffener and two or three inches away from it.

Fair heavier parts first

Sometimes buckles are completely removed from a plate welded into an assembly, only to reappear later in the same places. This is due very often to disturbances communicated from other parts of the assembly during welding or flame straightening of those parts. Sometimes it is the result of shrinking the plating in one direction only (or even over-shrinking it in that direction) when it should have been shrunk in two directions. Generally some cross heats, in the form either of rows of spots or lines across the panel of plating, employed as an adjunct to rows or lines parallel to beams or stiffeners, will furnish divergent shrinkage sufficient to hold the plating fair. A general rule of sequence for flame straightening which has proved efficient in most cases is to fair the heavier parts of the structure first, before the lighter adjacent parts are faired.

When too much heat is applied to the plating directly opposite the connecting welds, or when the temperature is raised too high, the upsetting actions make the stiffeners or beams bow outward. When beams or stiffeners are bowed thus, they can be drawn back and the condition rectified by heating the heels of the beams. In any case, before a deck is faired by flame straightening, the underside should be investigated, and the beams should be faired if they are are distorted, before straightening of the deck plating is begun.

For ship plating, a No. 10 single flame tip is commonly used on heavy decks and bulkheads, and a No. 6 or 8 tip on superstructures and other light plating, for either line heating or spot heating. Spot heating is also done effectively with a small multi-flame tip. Gas flow is regulated to produce a welding flame which is applied to heat the spots or lines as rapidly as possible, bringing the metal to not more than a dull cherry-red heat. At such temperatures the optimum combination of softening, expansion and upsetting effects can be obtained without bordering on the lowest critical temperature of the steel.

While the amount of shrinkage is controlled largely by the amount of heat applied and the way it is distributed, proper quenching with water or an air-and-water spray does serve to increase the degree of upsetting that is retained, as well as to accelerate the contraction. When quenching is used to increase the degree of residual upsetting, it should be directed first at the center of the heated area, and then at the surrounding metal. This freezes the metal at the moment of greatest upset, thus producing the maximum amount of shrinkage. When excessive temperatures are avoided, this direct rapid quench has been found to cause no undesirable effects upon ordinary carbon steel.

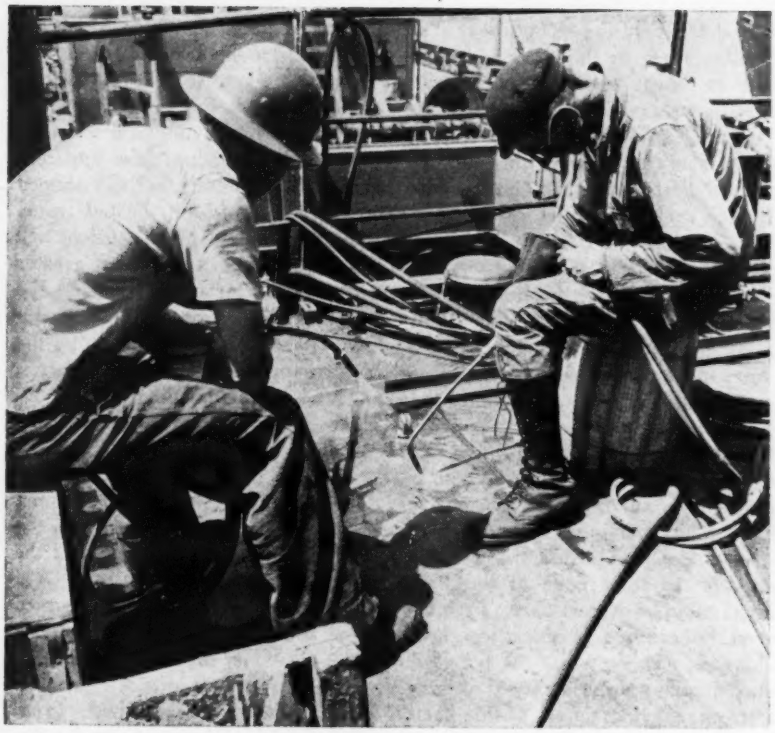


Fig. 3. "Fairing" or straightening ship plates in place may be done by one man heating followed by another quenching spot to secure maximum contraction.

An air-water spray mounted upon the handle of a heating torch is used in a number of shipyards. This device uses compressed air to direct a fine spray of water to the heated metal, following about one or two inches behind the flame. Some shops increase this distance somewhat, but a space of four inches or more is generally less effective than one or two inches. Another technique is to use two sprays, one on each side of the heated line to keep the heat localized. Most commonly, however, a separate spray jet is used by a second operator as shown in Fig. 3.

For spot heating with a multi-flame tip, the water spray ring shown in Fig. 1 has been developed. It has the added advantage of keeping the heat localized, since the quench is operated during heating as well as after.

Straightening structural members

Straightening heavy members such as structural steel angles or channels, booms or piping is best done by the technique of the V-shaped heat. The area heated should always be in the form of a V, with the mouth of the V facing the sides to be contracted; and this technique is followed regardless of the cross-sectional shape of the member to be straightened. An exception to this is in the treatment of hollow shafting or a thin-walled pipe section, where the heating of a broad area may tend to contract the section out of round.

Usual practice is to begin the heat at the apex of the V, Fig. 4a, progress gradually outward toward the mouth of the V, weaving the torch in ever-broader strokes. Naturally there is a limit to the amount of contraction that can be effected by a single heat, so it may be necessary in straightening a pronounced bend to repeat the operation one or more times. In the case of a sharp bend, it

is best to apply the second heat at a location close to the first V, rather than to reheat the same spot. If the bend is pronounced but not sharply localized, straightening is best accomplished by distributing the V-shaped heats over the entire misaligned zone, Fig. 4b.

In bending an I-beam, in the direction shown by the points of the shading in Fig. 4c, the heats would be applied to the shaded zones indicated on the web and flange.

When a T-shaped assembly is made with fillet welds, cupping of the flange often occurs, as well as some bowing of the element forming the stem of the T, unless the section is quite deep and stiff. Since this is the result of localized shrinkage stresses along the inside of the flange and the adjacent edge of the web, it can often be at least partly straightened by running a quick low heat along as narrow a line as possible, opposite the weld. This seems to have a stress relieving action. If this heating is overdone, to the point of causing appreciable upsetting, it can cause the section to bow worse. When the thickness of the flange plate is less than $\frac{3}{8}$ in., particular care must be exercised to avoid the use of too much heat and too high a temperature.

It is noteworthy that everything that has been said about heating for straightening purposes applies equally to heating as a bending operation. Sometimes the work can be expedited by external pressure such as by weighting, or by shoring or jacking in the direction in which the member is to be bent.

In cases where it is impractical to do otherwise, a flat plate may even be brought into cylindrical form by repeated line heating. Less apparent here, but still present, is the V-shaped cross-section of the heated zone. Proper handling of the torch will heat the plate to a somewhat greater width on the torch side than on the under side. This results in a graduated contraction throughout the thickness of the plate.

Finally, flame bending may be applied as a preliminary treatment to introduce reverse distortion in parts which will undergo subsequent procedures that produce warping, thereby leaving the member with the desired shape upon completion of the work.

Foremost among the advantages of flame straightening is that the structural members may be worked on without removal from position, even while under moderate load. From this come other virtues: Costs for dismantling and transportation to repair shops are avoided; interruptions, delays and shutdowns are cut to a fraction of what would otherwise occur; flexibility of flame straightening, and the easy mobility of the simple apparatus enable all the work to be done "on location," not only at the site but at the very spot where it is needed; one man with a portable outfit is all that is required for almost any job, or possibly one man to do the heating and a helper to handle the quenching and any jacking or shoring that may be applied.

Everything within reason should be done to prevent the formation of buckles during welding. Generally applicable precautions are: Fasten the plating down during the welding; "drum-head" the plates, holding them in compression while welding; use a skip welding pattern or a wandering sequence to distribute the heat uniformly; or use a general sequence that will balance the heat of welding. Temporary strongbacks across butt welds are very effective in attacking the problem at the source of a large part of the distortion—the angular distortion at butt welds.

A certain amount of distortion is inevitable in many cases, despite precautions taken. It is reassuring to know that a process as simple as flame straightening is readily adaptable for removing any warps or buckles that cannot be prevented.

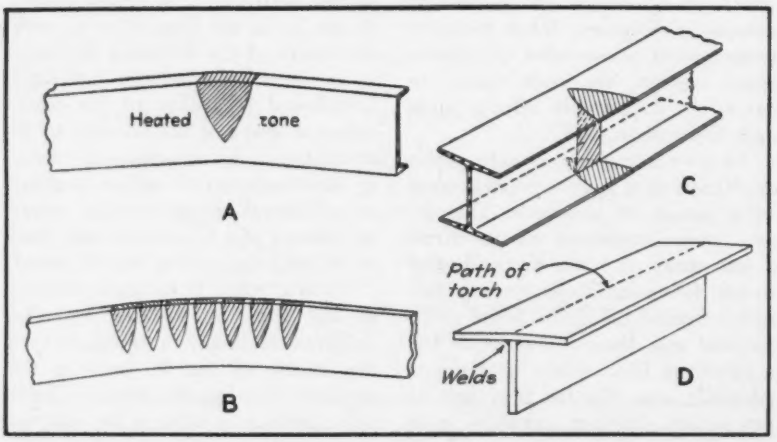


Fig. 4. (A) Contraction on upper side of member by single V-heated area draws it into line while (B) several heated areas can be used to straighten a pronounced but gradual bend. (C) I-beams can be straightened by applying the flame with broadening strokes to web and flange. (D) Warping of this fillet-welded T-beam can be corrected by heating a narrow strip opposite the weld.

Milwaukee Paving Work To Require No Steel

Concrete pavements requiring no reinforcing steel or other critical materials have been designed by paving engineers at Milwaukee, Wis., in order to rebuild 100 miles of the city's streets without requiring priorities, according to R. W. Gamble, superintendent of street construction. By eliminating critical materials from the paving program Gamble hopes to obtain permission from the Public Roads Administration and the WPB to proceed with construction this year on a $500,000 program.

"Many of our streets are in poor condition," said Gamble, "and to spend money continually repairing them is wasteful. The longer construction of new streets is delayed, the longer it will take to catch up to our normal program."

Instead of providing the usual steel reinforcing rods at slab joints, the new design calls for thickened slab ends to carry traffic loads, and the increased cost of concrete in the thicker slabs will be offset by the saving effected in reinforcing steel, said Gamble. The only critical materials required for this 100-mile repaving program will be water and gas mains, both of which are adequately stocked by the city water department and the Milwaukee Gas Light Co. However, WPB permission to use the mains already fabricated must be obtained.

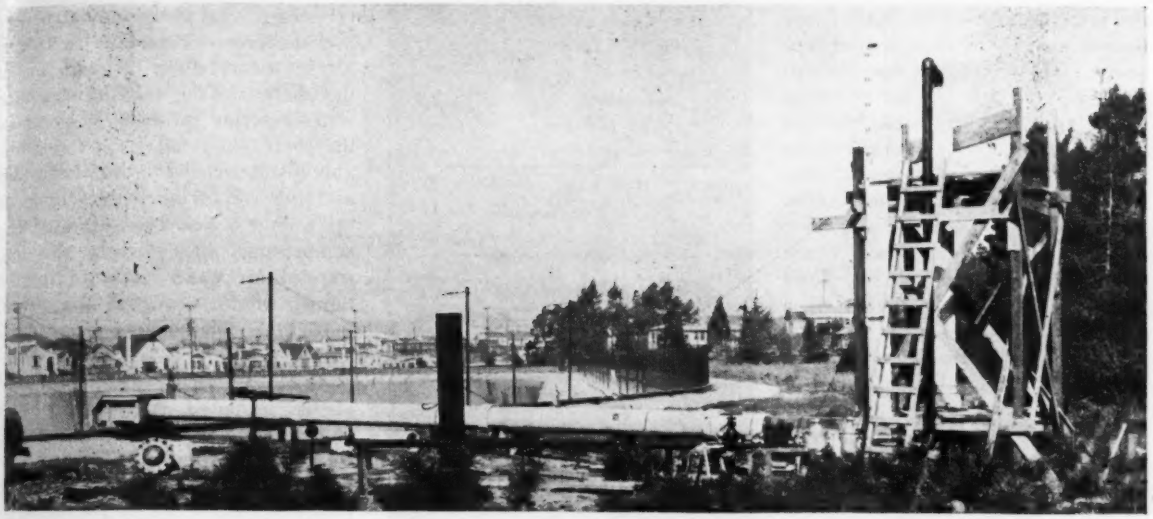


Fig. 1. Tests were made beside a reservoir where it was convenient to recover water passed through the model.

Design of Circular Spillway Modified To Cure Pulsating Discharge

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***Contents in Brief** — Air was entrapped, with destructive results, in a vertical shaft wasteway at San Pablo Reservoir in California. Changes in design, to prevent free fall of water in air, are expected to end the trouble; an expectation confirmed by tests on a model of the revised design.*

When San Pablo Dam, an earthfill 220 ft. high, was built some 25 years ago on the east side of San Francisco Bay, the intent was to make use of two means of wasting water—one, an open chute spillway, and the second a vertical shaft wasteway. The latter was first used only 7 years ago, at which time entrapped air emerging from the discharge tunnel caused such violent reactions that the resultant vibration ruptured the tunnel lining.

An anlysis of hydraulic conditions antecedent to this destructive action suggested a simple remedy and reconstruction of the shaft and tunnel to this end is now under way. To check and confirm expected results, a model of the vertical wasteway constructed according to the revised plans was built by the East Bay Municipal Utility District.

After the Mokelumne River supply was added to sources serving the East Bay cities, the San Pablo Reservoir was used to more nearly full storage capacity than before. A survey made at that time of previously unused wasteways at the dam suggested the need for alterations and repairs. The shaft wasteway presented particularly interesting problems because the first time it was used water escaping from the discharge tunnel released "exploding bubbles" with the violent action mentioned.

Operation of shaft wasteway

The discharge tunnel is 14½ ft. in diameter and is located in the south abutment where it was used for diverting streamflow during construction of the dam. Later a concrete plug was put in to close off the upper end and a concrete-lined vertical shaft, in diameter equalling that of the tunnel, was carried up to reservoir surface level, thus providing a means for discharging water from the reservoir through the lower 728 ft. of the diversion tunnel.

The upper portion of this circular shaft flares outward to a diameter of 33 ft. at the lip of the circular spillway at the top. This lip is 158.8 ft. above the center line of the tunnel and the vertical axis of the shaft is 8 ft. to one side of the tunnel center line. The tunnel has a slight downgrade and at its lower end there is a stilling pool which keeps the discharging portal submerged at all times.

In addition to discharge of water over the circular spillway, flow into the shaft as originally built could occur through three 5-ft. square slide gates on the sides of the shaft over 5-ft. round openings. Two of these are 106.35 ft. and the third is 128.85 ft. above the tunnel center line.

In 1936 when the shaft wasteway was first used to release water from

the reservoir, these slide gates were opened enough to pass a discharge about 350 sec.-ft. It was air entrapped with this discharge whose violent release at the portal cracked the tunnel lining. Thereafter no flows greater than 150 sec.-ft. have been permitted through these gates. Although this lesser flow has caused the same kind of turbulence in the discharge, the violence at low flows is so much reduced that no further damage has occurred.

Under this operating program, however, if any trouble developed in the slide gates or if the shaft lining were to fail for any reason there would be no means of controlling discharge. Reconstruction, it was therefore decided, should provide some additional means for controlling the discharge and should prevent the entrance of air that caused the violent action at the tunnel portal.

Fig. 2. Bubble explosion in the model as water emerges from discharge tunnel is characteristic of action in prototype.

Entrance of air prevented

Accordingly, a concrete plug was designed for the junction of shaft and tunnel where passages, each with a slide gate, can control the flow that enters the tunnel. These slide gates are operated by hydraulic cylinders mounted in the concrete plug and served by a hand pump located on the bridge over the shaft. In the tunnel portal structure a weir is provided which insures submergence of the high-velocity jet issuing from the passages in the concrete plug and prevents any hydraulic jump in the tunnel.

With these alterations, discharge can be varied by opening one, two or three of the slide gates at the bottom of the shaft. Thus, any failure of the shaft or of the gates leading into the shaft will not leave discharge uncontrolled. Moreover, with the new plug, the gates into the shaft can be left fully open, decreasing danger to the shaft structure and making it impossible to entrap air in water falling through air in the shaft. In the original structure water entering through the gates in the shaft walls fell for a considerable distance down the shaft through air, thus employing the principle of the trombe which has been used for compressing air. It was this entrapped air under pressure in the tunnel whose escape at the portal caused the violent reactions and damage.

To observe the effect, in miniature, of the proposed design changes, a model of the revised shaft wasteway was built and tested. The ratio of linear dimensions between model and prototype was 1:14.5; the velocity ratio 1:3.81 and the flow ratio 1:800.

In the model, transite pipe was used for the greater portion of vertical shaft and tunnel. The concrete plug with controlled openings into the tunnel was modeled in teakwood. That portion of shaft and tunnel representing the passages through the new plug and part of the tunnel immediately beyond, was built as a celluloid tube so that flow could be observed in the region where velocities would undergo their greatest reduction. Manometers were placed at various locations to give definite figures on pressures.

The overflow structure above the existing shaft was not modeled nor were the slide gates on the shaft sides, because these features do not have any effect over which concern was felt. The model was built beside one of the reservoirs so that water loss would be avoided by allowing the discharge to flow into the reservoir.

Water discharged into the top of the model from a 4-in. pipe was regulated by a 4-in. gate valve and measured by a 6-in. compound meter. Manometer readings and rates of flow were taken at various heads on the model for conditions representing one, two or three slide gates open and also with the teakwood block removed, that is, representing a condition prior to putting in the portion of the new plug containing the openings.

The first test was run under conditions simulating the original design of the shaft wasteway. Through the celluoid walls large quantities of air were seen to form as the result of numerous bubbles which accumu-

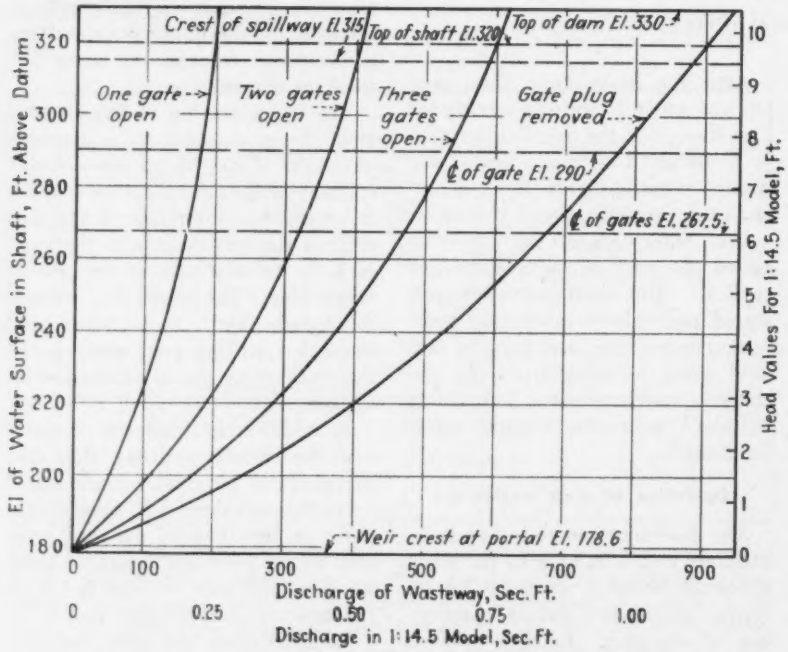
Crest of spillway El.315
Top of shaft El.320
Top of dam El. 330
One gate open
Two gates open
Three gates open
Gate plug removed
℄ of gate El. 290
℄ of gates El. 267.5
Weir crest at portal El. 178.6
El of Water Surface in Shaft, Ft. Above Datum
Head Values For 1:14.5 Model, Ft.
Discharge of Wasteway, Sec. Ft.
Discharge in 1:14.5 Model, Sec. Ft.

Fig. 3. Discharge rating curves for the redesigned shaft wasteway.

lated along the top of the discharge pipe. This air discharged at the portal in expanding bubbles creating periodic explosions of the same type that occurred in the 1936 operation of the prototype. This air was found to enter the model from two sources: in the vertical shaft section where the free falling stream carried it down and also through one of the manometers where the pressure was less than atmospheric.

The manometer that admitted air was closed and the quantity of water put through the model was increased until the water level in the vertical shaft submerged the end of the supply pipe. At this point the air troubles ceased.

Exploration of hydraulic conditions in the model, after all risk of entrapped air had been eliminated, showed that manometer readings for locations where high velocities existed did not indicate the elevations of hydraulic gradients but merely the pressures against the pipe wall at the particular point where the taps entered. The observations also showed that lower-than-atmospheric pressures existed over isolated areas of the pipe shell and that the locations of these low-pressure areas changed with the opening of the different combinations of ports in the teakwood block. With three ports open air was taken in only through the manometer tap located at the inside of the sharp elbow. With two ports open air was sucked in only through the manometer tap just below the celluloid pipe flange.

Fig. 4. Celluloid portion of the model.

From data in the model test a set of curves was plotted showing the discharge rating curves for the model and for the prototype.

The model tests confirmed the conclusion that when alterations are completed the shaft wasteway will provide all the advantages anticipated when the revised plans were drawn up. The only change made in the design after the model tests was an increase in the radius of curvature of the sharper bend in the passage through the plug at the junction of the shaft and tunnel. This change was made because it was believed that the turbulence of the flow through the plug might thereby be reduced.

The redesign of the shaft wasteway and the tests with the model were conducted under supervision of J. S. Longwell, chief engineer and general manager, East Bay Municipal Utility District.

Difficult Submerged Rock Removal Undertaken in Seymour Narrows

A menace to navigation in the swift tidal currents of Seymour Narrows, British Columbia, is now being attacked from a barge constructed especially to meet the unusual working conditions at this spot. The location is in a narrow channel through which must go all water traffic that follows the "Inside Passage" from Puget Sound to the north. Tidal velocities have been reported as high as 15 knots, and there is a series of whirlpools and overpours at the narrowest part of the channel where Ripple Rock rises to 18 ft. below the surface.

So adverse are the conditions under which drilling and blasting will have to be carried on that the government's call for bids on this work last fall brought no responses. Subsequently an arrangement was made with the British Columbia Bridge & Dredging Co., Vancouver, to drill and blast away the pinnacle to a depth of 30 ft. below lowest water level.

To accomplish this a special barge was built, costing about $50,000, and about the same amount was spent on equipment. The barge deck is 150 x 45 ft.; there is a scow-like rake at bow and stern with a knuckle at the water line amidships to minimize the disturbing effect of swift currents.

In addition to shore anchor lines there will be six concrete anchors, four of 125 tons each and two of 250 tons. These are to be dropped in the channel in 20 to 30 fathoms of water, and the 1½-in. main anchor lines will be carried over steam-powered drums to maintain flexibility of control.

On one side of the barge there is a steel drill tower 60 ft. high which travels on a track to permit drilling six holes in a row without shifting the barge. The holes will be about 7 in. in diameter and some may have to be more than 20 ft. deep. Each hole will be loaded, by means of a tube, with 75 percent gelatine powder immediately after the drill has been withdrawn. Not more than six holes are to be shot at one time; the charge is to be 2½ to 3 lb. of powder per cubic yard of rock.

Guides for the drill consist of two 10-in. H-beams at the bottom of which is fixed a section of tubing to exclude rock from the hole until after the powder charge has been placed. It is planned to work in from the side of the rock, drilling successive rows of holes parallel to the edge so that the shattered rock will have a tendency to slide off into deep water. The strong currents are expected to help remove broken rock.

The barge is completely equipped for a crew of 20 and work may have to be continued from six months to a year according to conditions that develop. Drilling will be done only between periods of full tidal flow—this may mean from slack water up to a current of about eight knots.

A scale model of Seymour Narrows was constructed at the University of Washington and a series of tests were made on a scale of 20 ft. to the inch. From information gained in these tests a model barge was built on a scale of 2 ft. to the inch and after further tests with this model the barge designs were finally approved. Part of the plan to simplify the drilling is the erection of a dam closing a narrow passage near the rock through which cross currents entered the main channel.

Methods and equipment have been developed by W. C. Mackenzie, president, and L. G. Murray, chief engineer of the British Columbia Bridge & Dredging Co.

New Method for Handling Appeals Under War Department Contracts

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OF VITAL INTEREST to all contractors doing business with the War Department is the department's new Board of Contract Appeals, which was brought into existence on Aug. 8, 1942, and now has been functioning for several months. For many years all executive departments, including the War Department, have reserved in their contracts the right finally and conclusively to determine all disputed questions of fact. Such disputes have revolved principally around what is to be allowed for changes, extras, the existence or nonexistence of subsurface conditions materially different from those shown on the drawings, and extensions of time necessary to avoid the assessment of liquidated damages.

The administrative procedure heretofore set up in the contract has called for the contracting officer to determine such disputes. In the event his determination was unsatisfactory, the contractor was given the right to appeal within 30 days, in writing, to the head of the department.

Written appeals required

Appeal from the decision of the contracting officer or from the chief of a supply service now takes the form of a written petition, signed and sworn to by the appellant. Six copies of it must be filed with the officer from whose decision the appeal is taken within the time provided in the contract, which is usually 30 days, unless the board shall waive that time requirement.

The petition must state the particular provisions of the contract out of which the dispute arises, the exact nature of the dispute, and the ruling of the contracting officer, together with a statement of specific facts claimed by the contractor to sustain his position. If the appeal is insufficient in these respects, the board reserves the right to return the appeal for amendment.

When the appeal has been received by the contracting officer he will endorse thereon the date of its filing. He will also prepare and sign a statement of fact, a copy of which with his written decision will be furnished to the contractor.

Personal appearances authorized

The contractor is given a right to be heard before the board. Ordinarily the hearings will be held in the office of the board in Washington, but if the contractor desires to be heard at some other place he may at the time of taking his appeal or within a reasonable time thereafter make such a request, stating fully the reason for his request. Such a request must be made before he receives the formal written notice of hearing from the board. The formal notice of hearing provides at least ten day's advance notice of the hearing to be held by the board.

No informal conferences

The method of presenting proof before the board is radically different from the old informal conferences that were sometimes held prior to the rendition of the appellate decision. Now, definite provision is made for either or all of three forms of proof. The first of these is proof by stipulation. The contractor and the government's representative may stipulate or agree upon various facts that are not in dispute, and upon these no proof is required. Second, the contractor and the government may present oral testimony, given under oath. Statements in the petition for appeal or affidavits or statements in briefs do not any longer constitute evidence or proof. Third, where the contractor or the government cannot bring on the necessary witnesses, provision is made in the rules for the taking of depositions after giving ten day's notice. The deposition may be taken either upon written interrogatories or upon oral examination as provided in the notice.

All of these departures are an attempt to have the board function much in the same manner as a court. At first blush, a normal reaction to this procedure would be that it unduly complicates the taking of an appeal. However, the procedure set up, if reasonably carried out, should prevent the recurrence of the unsatisfactory situations that developed frequently in the past. Time alone can show whether it will have this much desired effect.

Administrative determinations made by the board will be on the same legal parity as decisions heretofore made by representatives of the head of the department. In the event that such decisions are grossly erroneous, arbitrary or unfair, the Court of Claims doubtless will continue to set them aside. Otherwise, they will constitute a final determination of the facts. In the event that the board should go beyond its contract duty of deciding disputed *questions of fact*, and attempt also to decide the law of the contract, there is ample legal authority to support the view that the court will ignore the legal aspects of the board's decision.

Representation before the board

On the matter of representation before the Board of Contract Appeals, the rules provide that an individual contractor may appear for himself. A partnership contractor may be represented by one or more of the partners. A corporation may be represented by a bonafide officer of the corporation. Contractors are at liberty to be represented before the board by attorneys, if they so desire.

The possible effect that renegotiation of a contract might have upon a dispute is recognized by the board. Prior to any hearing, the board is required to ascertain from the War Department Price Adjustment Board whether any renegotiation agreement has been accomplished relating to the contract under which the appeal is pending or whether renegotiation proceedings relative to the contract are pending.

Appeal to the new board is part of an administrative procedure set up in War Department contracts. Failure of a contractor to observe the requirements thus placed upon him will act as a forfeiture of any right that he might otherwise have to appear in the U. S. Court of Claims or to seek redress of his grievances in any other court.

Photos by Signal Corps, U. S. Army

Engineers at Camp Claiborne are taught to build ponton bridges though they do not carry ponton equipment with them.

Training Army Engineers for General Construction Abroad

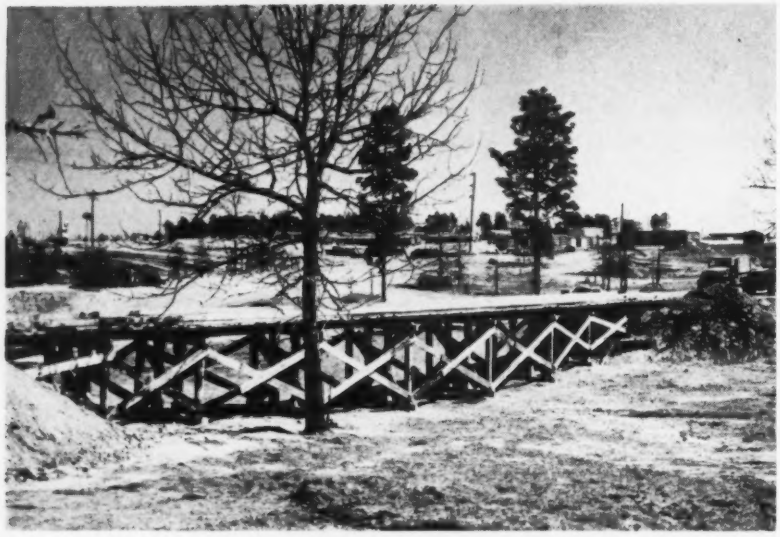
V. T. Boughton
Associate Editor, Engineering News-Record

***Contents in Brief**—Army engineer regiments staffed and equipped to undertake any kind of construction behind an army in the field are being trained at Camp Claiborne, La. Officers are drawn in part from the construction industry, and a large part of the enlisted personnel is made up of skilled men from the construction and mechanical trades. Also, being trained at Claiborne are engineer specialist companies and detachments whose work will supplement that of the larger regiments.*

A YEAR AGO in April, six officers of the Corps of Engineers moved into a camp site at West Camp Claiborne, a part of Camp Claiborne, La., to start a new venture in the training of engineers to meet the expanding needs of the Army. To them had been assigned the task of organizing the training of general service and special service regiments to take over any type of construction operation that global warfare might demand. Later, training of a variety of specialist companies and detachments was added to their assignment. These latter units are to repair or do extraordinary maintenance on equipment of the general service and special service regiments, to supply them with special equipment or repair parts, to take over forestry operations, to repair and operate water, power or fuel services, and to do a variety of other tasks.

The new special service and general service regiments differ from combat engineer regiments in that they take into the field a considerable amount of construction equipment and each regiment contains a large number of men skilled in each of the many trades required for general construction in the field; they are similar to combat units in that the officers and men are fully trained as soldiers and will go into the field adequately armed.

Before this nation entered the war, large construction operations abroad, for both the Army and Navy, were executed by civilian contractors specializing in such work. But the outbreak of war made it all too apparent that such a system could not be continued. Men untrained in the fundamentals of defense found themselves right in the thick of battle on our out-



Trestle bridge construction is a major element in the engineer unit training. Using simple tools such as the ginpole, the engineers build trestles across man-made gulches that must stand up under a medium tank running at high speed.

lying bases. Not only were they untrained and unequipped to defend themselves, but they might be held to have a questionable legal status if perchance they helped to defend the bases and were captured when the defenses were overwhelmed.

Military constructors needed

But there was an even more imperative reason for the organization and training of construction units that could go into the field prepared either to fight or to undertake a variety of general construction operations. That was the need for a vast amount of construction of all types and at any one of many points abroad where an expeditionary force may be landed. Airfields and facilities must be built or repaired, storage depots and housing provided, roads and rail lines built or reconstructed, bridges replaced, and sanitary facilities provided. And as the armies advance, there must be construction units ready to restore or provide road and rail transport and to maintain fuel, power and water supplies. Also, there must be units prepared to construct advance bases to which supplies can be moved in bulk. In brief, the function of these new engineer units is to provide any type of construction that an army needs to maintain its mobility.

Present thinking with respect to construction operations with armies in the field is in sharp contrast to that of 1917 when the Corps of Engineers was being expanded rapidly to meet the needs of the American Expeditionary Force in France. The first engineer units to be organized in 1917 were construction and operating regiments for both standard-gage and light railways, because military missions sent to France had reported that such units were a major need behind the British and French fronts. Those railroad regiments were followed by highway, forestry, water supply and other specialist regiments as the staff of the A.E.F. began to plan to function independently in France. However, the railroad construction regiments in fact became general construction regiments upon arrival in France. Some were set to building port facilities and storage depots, and before the war was over they even dug trenches and were assigned to man them as combat troops in an emergency.

Less specialization

Lessons learned by the A.E.F. in France and those learned more recently on our Pacific bases are evident in the organization and training of engineer units now actively in progress at West Claiborne. The basic unit is the general service regiment of about 1,300 officers and men, trained and armed as a military unit and supplied as to personnel with officers and men skilled in general construction. Each regiment consists of six companies of 176 men each and a headquarters and service company of 134 men. The amount of specialization in these regiments is indicated by the fact that 27 of the 45 engineer officers are required to be engineers with a background of some kind of general construction. The other 18 are officers specially trained in combat and pioneer operations, in general being graduates of the Engineer Officers' Candidates School. Of the 1,241 enlisted men, all but 183 are skilled construction men, mechanics or craftsmen of various types, or are military non-commissioned officers or specialists such as first sergeants, mess sergeants, cooks, clerks, etc.

To supervise local labor

Another type of engineer regiment now being trained at Camp Claiborne, which shows the influence of experience gained in the A.E.F. in 1917-18 and more recently by the engineers of the United Nations in their worldwide activities, is the special service regiment. Its function is to

supply the supervisory skill for direction of a large number of local laborers in field construction operations. For that reason, these regiments differ from the general service regiments in that each has a much larger number of some trades. The major trades called for in each type of regiment are shown in Table I.

Specialist companies

To supplement these larger units, or to carry out special missions, are numerous special companies, or detachments, ranging in size from an engineer gas-generating unit with an enlisted strength of 21 men for supplying oxygen and acetylene gas for use of welders and cutters, to an engineer heavy-shop company with five officers and 193 enlisted men, all but 18 of whom are specialists such as foundrymen, mechanics, welders and tractor operators. Other of these units —to mention the principal ones—are dump-truck companies, engineer parts supply companies, engineer equipment companies, engineer maintenance companies, engineer forestry companies, engineer depot companies, engineer utility detachments, and petroleum distribution companies. The latter units, consisting of about 275 officers and men, go into the field with pipe, pumping equipment and tanks prepared to build and operate fuel supply systems to serve advance units, thus cutting down the amount of gasoline and oil that must be hauled overland in tank trucks.

Much construction equipment

Each general service regiment goes into the field with a considerable amount of construction equipment, as will be seen by an examination of Table III. Other equipment that they may need for the special tasks to which the service regiments may be assigned is supplied by one or more of the dump-truck companies or by an equipment company. The latter units take into the field such special equipment as concrete mixers and pavers, cranes, large shovels, rock crushers and gravel-screening plants.

Provisions are made for the maintenance of construction equipment in the field. Minor repairs are made within each company by the mechanics and operators of the company's normal complement of equipment. Repair work of somewhat greater magnitude is done by the regimental service unit, which is equipped with a mobile shop having a lathe, drill press, welding equipment and a large variety of tools. Repair and overhaul work that cannot be done within the regiment is done by one of the maintenance companies, which are expected to go into the field along with the armies as they move ahead. If the repair work is beyond the capacity of these companies, the equipment is shipped to the nearest base where one of the heavy shop companies takes over the repair work in large shops set up for that purpose.

TABLE I—PRINCIPAL SKILLED TRADES IN THE GENERAL SERVICE AND SPECIAL SERVICE REGIMENTS

Skilled Trades	General Service Regiments	Special Service Regiments
Auto mechanics, foremen	1	2
Auto mechanics, general	15	28
Diesel mechanics		4
Blacksmith, foremen		7
Blacksmith, general	7	6
Tooldressers		6
Demolition men	54	7
Carpenters, bridge, foremen		6
Carpenters, bridge	61	18
Carpenter, dock, foremen		1
Carpenter, foremen		31
Carpenters, construction	115	14
Construction foremen	123	120
Construction foremen, railway		7
Construction foremen, concrete		6
Draftsmen, general	7	7
Draftsmen, mechanical	1	2
Draftsmen, structural	1	2
Draftsmen, topographic		2
Designers, structural	1	
Powerhouse engineer	1	
Electrician, foreman		1
Electrician, general	56	7
Engineman, air compressor	8	17
Foremen, mechanic	6	7
Steelworkers, structural	18	6
Mechanics, general	58	39
Duplicator operator	1	1
Painters, general	6	6
Pipefitters	6	13
Plumbers	1	
Lineman, power	1	1
Linemen, tel. & tel.	2	1
Electrical engineers		6
Quarrymen, foremen		25
Quarrymen	54	
Riggers, foremen		6
Riggers, general	55	25
Rodmen		8
Technicians, sanitary (Med.)	1	1
Sectionhands, railway	36	19
Sheetmetal workers	18	24
Surveyors	2	4
Surveyors, instrumentmen		4
Toolroom keepers	27	26
Tractor drivers	8	14
Truck drivers, light & heavy	101	202
Water supply foremen	1	
Water supply engineers	6	10
Welders, combination	8	7
Stock clerks	6	6
Powershovel operators	2	1
Foremen, crane operators		6
Crane & shovel operators		6
Concrete mixer operator		1
Chauffeurs	9	5
Jackhammer operators	54	
Earth auger operator	1	
Highway machine operators	2	31
Mechanics, tractor		1
Rockcrusher operators		6
Hoist operators		12
Motor boat operator		1
Motorcyclists	8	10
Dispatcher, motor transp.	1	1
Carburetor specialist	1	1
Camoufleur	1	1
Motor sergeants	8	14
Non-specialists	147	171

Rates of pay for enlisted men in engineer units are given in Table II. Most men in these units get pay above that of a private. Pay for skilled craftsmen such as highway machine operators ranges from that of corporal up to staff sergeant, each unit having a definite number of higher grades to which men showing special ability can be promoted.

TABLE II—BASE PAY OF ARMY ENGINEERS

Private	$ 50
Private, First Class	54
Technician, 5th Grade	66
Corporal	66
Technician, 4th Grade	78
Sergeant	78
Technician, 3rd Grade	96
Staff Sergeant	95
Technical Sergeant	114
First Sergeant	138
Master Sergeant	138

In addition, master sergeants, first sergeants, and staff sergeants are entitled to $37.50 monthly quarters allowance, if they are married. All men below the grade of staff sergeant, if they have dependents, are eligible for family allotments. These allotments vary with the relationship of the dependent. A wife, for instance, receives $50 per month—$28 from the government plus $22 from the pay of the soldier.

Twenty percent increase is added to base pay for service outside the continental United States.

Unit training started

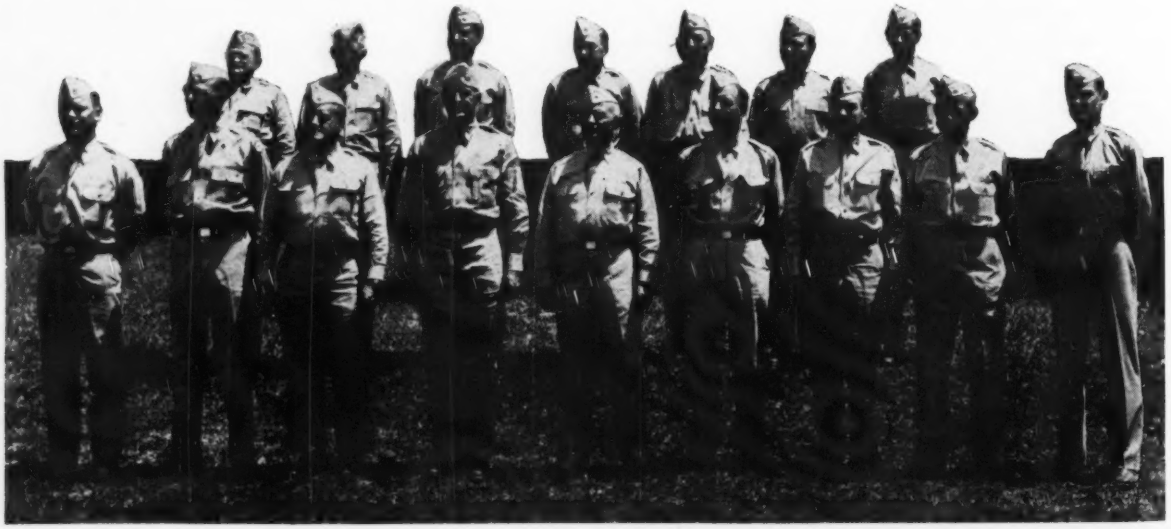
Engineer unit training at Claiborne was inaugurated on April 15, 1942, when Brig. Gen. John W. N. Schulz arrived, accompanied by Col. M. G. Martling, executive officer, Col. L. C. Ritchie, director of the Officers Training School, Lt. Col. W. H. E. Dunham, to direct the plans and training operations; and Lt. Col. T. C. Combs, to head up the supply work, and Lt. Col. K. D. Willoughby, to head up the administrative work. Until unit training at Claiborne was inaugurated, regiments and other engineer organizations were trained locally under the supervision of their commanders. Activities at Ft. Belvoir and Fort Leonard Wood were devoted primarily to the training of individuals. To General Schulz and his staff was assigned the task of training complete regiments, companies, and detachments ready to be sent to any part of the world.

When General Schulz started development of the Engineer Organization Center at West Claiborne—now known as the Engineer Unit Training Center—it was expected that his staff would undertake the training of a definite number of regiments and specialist companies and then would close up the camp. The center, which started as a tent camp, was built as a "theater-of-operations" project with the temporary structures specified for such projects rather than the more permanent structures of most army training centers. The initial program called for training 12 general service and special service regiments and ten dump-truck companies, a total of about 17,000 officers and men. However, expanding army needs since the first plans for the training center were laid down early in 1942 have quite changed the picture. The center has expanded greatly, although retaining its character as a theater-of-operations camp; and while the number of units that have been trained to date and their strength may not be given, it can be said that the initial number has been surpassed many times.

Later, the training work at Claiborne included the training of engineer units to take over the operation of rail lines in any theater of war. Several such railway battalions were trained at the center last year, but organization and training of these units now has been taken over by the Transportation Corps. Some airborne engineer battalions also were trained at the center.

Training center problems

Two problems were placed on the officers who inaugurated the Engineer Unit Training Center at West Claiborne: first, that of developing a training program for officers and men; second, as the training program expanded, that of developing additional training areas that in physical equipment and arrangement of structures would provide the needed facilities at a minimum of cost in time and materials. In addition to the drill



Staff of the Engineer Unit Training Center. Front row, left to right: Lt. W. L. Schollander, aide-de-camp; Lt. Col. T. C. Combs, chief of supply section; Col. R. M. McCutchen, commander, Third Provisional Training Brigade; Col. H. L. Robb, commander, Second Provisional Training Brigade; Brig. Gen. John W. N. Schulz, commanding general, Engineer Unit Training Center; Col. M. G. Martling, E.U.T.C. executive officer, and commander, First Provisional Training Brigade; Lt. Col. W. H. E. Dunham, chief of plans and training section; Lt. Col. K. D. Willoughby, chief of administration section; and Lt. K. E. Trombley, aide-de-camp. Back row, left to right: Col. L. R. Maddox, chief of special services section; Col. Lloyd R. Ritchie, director of schools; Lt. Col. E. W. Carr, assistant executive officer; Lt. Col. J. E. Swift, surgeon; Major A. G. Alexander, inspector general; Major D. T. Udall, judge advocate; Major W. S. Crocker, adjutant.

fields required for the training of all military units, these engineer units needed areas for training in such operations as simple bridge construction, rigging, road-building, use of construction equipment, and other specialities or military subjects.

New area laid out

The camp site, initially turned over to the training center, was laid out on a rectangular basis common to most army camps, with little attention being given to the rolling formation of the ground. This resulted in much cutting through the underlying loess and soft clay. Also, buildings had to be set partly on high foundations or on terraces cut into ground because their long dimensions often were not parallel to the contours.

When conversion and expansion of the camp was undertaken, four new regimental areas were constructed. Layouts were fitted to a topographic map of each area, adjusting the layout to minimize changes in natural drainage and ground surfaces. Similarly, the buildings for each regiment were set, not to a rectangular pattern but to conform to the contour of the ground. The result was a surprising saving in grading and in foundations, with a gratifying decrease in road costs. Also, close conformity to the contours of the land materially reduced the trenching required for utilities. An intangible but very real benefit was the creation of much more livable and convenient camps for the units that moved into the new areas.

As part of the final training of regiments organized in the center, the larger units are sent out into the training areas adjoining Camp Claiborne to apply camouflage and tactical principles in field operations. Officers are required to provide necessary roads and training areas with a minimum of disturbance of existing roads, trees and ground formations. This also gives the officers experience in developing natural protective concealment for their units in the field. This period is devoted to engineer construction and combat training, in extended exercises under battle conditions, to develop teamwork and capacity for sustained effort.

Training officers

Officers for new units come in part from other units and in part directly from civil life or from the officer candidate school at Ft. Belvoir. Those from civil life, generally, are men with an engineering or construction background needed for the units to be trained at the center. Before being assigned to a unit they are put into the officers training school at the Camp Claiborne Engineer Unit Training Center for six weeks of intensive work designed to give them essential military background. Hence, training is centered on such matters as military formations and discipline, company administration, equipment and supply, tactics, scouting and patrolling, and the use of the rifle, pistol and machine gun. Also included is training in some of the special skills that later must be taught to the enlisted men in their regiments, such as rigging, construction of fixed and movable bridges and simple field fortifications.

During this training, the officers in the school are organized into provisional companies and are drilled and handled just like enlisted men. Emphasis is laid on leadership and ability to handle men under conditions quite different from those in civil life. Special stress is laid on the fact that in the army an officer is completely responsible for the health, welfare, feeding and shelter of his men 24 hours a day.

Officers for training the first units to be organized at West Claiborne were loaned from Belvoir and Leonard Wood and other sources while the untrained officers for those units were being put through the officers training school. Those initial officers received only an intensive two-weeks

Heavy construction equipment is taken into the field by equipment companies, to be furnished to construction regiments as needed.

TABLE III—CONSTRUCTION EQUIPMENT OF GENERAL SERVICE REGIMENTS

Regimental Headquarters and Service Unit

- 8 2½-ton cargo trucks
- 2 2½-ton cargo trucks with winch
- 2 4-ton cargo trucks with winch
- 1 4-ton wrecker and winch
- 2 6-ton prime movers with winch
- 2 ¾-ton weapon carriers
- 2 ¾-ton command cars
- 2 ¼-ton trucks (jeeps)
- 2 solo motorcycles
- 10 1-ton trailer
- 2 35-hp. angledozers
- 2 equipment trailers (for angledozers)
- 2 motor graders
- 2 ½-yd. gasoline shovels
- 1 motor repair shop
- 1 earth auger
- 2 air compressors, with air lines and air tools
- 1 5-kw. lighting set
- 2 sets of water supply equipment
- 2 oxy-acetylene welding sets
- 1 electric-arc welding and cutting set

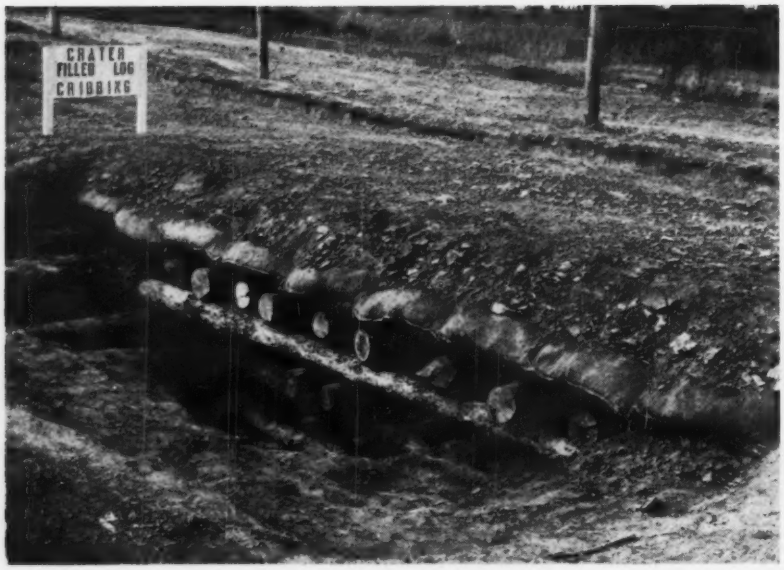
Equipment for each of the six companies in a regiment

- 1 4-ton cargo truck with winch
- 1 2½-ton cargo truck with winch
- 4 2½-ton dump trucks with winch
- 3 ¾-ton weapon carriers
- 4 1-ton cargo trailers
- 1 command truck
- 1 solo motorcycle
- 1 angledozer
- 1 trailer (for the angledozer)
- 1 air compressor with air lines and tools
- 1 gas-driven chain saw
- 3 sets demolition equipment

TABLE IV—SURVEYING EQUIPMENT

- 1 planetable and alidade
- 2 transits
- 1 level, engineer's
- 2 hand levels
- 2 level rods
- 4 stadia rods
- 2 stadia computers
- 2 barometers
- 3 tapes
- 1 sliderule

This equipment is carried into the field by the headquarters company of each general service regiment.



Quick and satisfactory means for filling bomb craters in roads and airfields are taught at Camp Claiborne. Where timber is available, much time can be saved by properly placed cribbing.

training instead of the six weeks now given.

An important part of the training program is the training of "cadres," each of which will form the nucleus of some future unit. The cadre for a regiment consists of seven officers and 95 men, chiefly the administrative and "housekeeping" unit of the regiment, sergeants major, first sergeants, platoon sergeants, supply and mess sergeants and cooks. This training of cadres is accomplished by giving most of the non-commissioned officers in each unit in training at least one understudy, or by use of specialist schools.

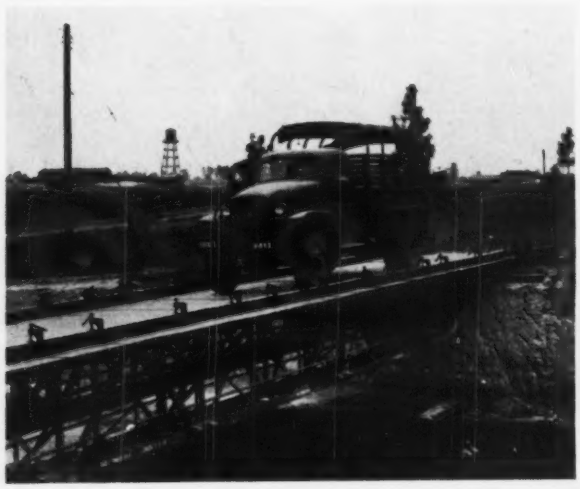
If the cadre being trained within a regiment has not been taken from the regiment before it leaves Camp Claiborne, the training cadre helps the regiment with its embarkation tasks when it comes to leave the camp. This gives the cadre experience that will be of value to the unit to which it ultimately is to be assigned and of which it will become a permanent part.

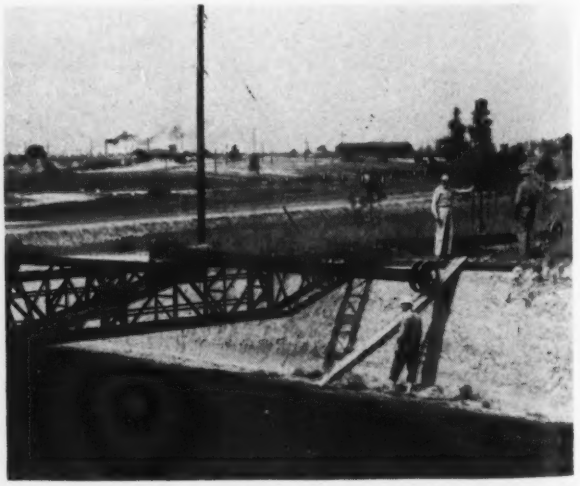
The commanding officer and about 15 other officers for each new engineering regiment to be organized at Claiborne, generally, are assigned to the regiment by the Office of the Chief of Engineers when the unit is first activated. From the engineer unit training center at Claiborne, each unit, as activated, gets its cadre of seven officers and 95 actual or potential non-commissioned officers as well as a large number of senior officers from the pool of officers at Claiborne who have completed their course at the officers training school and are serving with units in the center. The remaining junior officers come from the Engineer Officers' Candidate School at Ft. Belvoir.

Training enlisted men

As in the case of officers, training of enlisted men is centered on military operations rather than on general construction or other technical work, in some element of which most of the men are supposed to be proficient. However, due to the fact that a sufficient number of men skilled in all the trades that are required for the unit are not always available, provision has been made for training many men in various trades.

Twenty-eight specialist schools are being conducted at Camp Claiborne at the present time. These are: rigging, demolition, logging and sawmill, carpentry, blacksmithing, electrician, electric welding, acetylene welding, motor maintenance, vehicle operation, heavy construction equipment, well drilling, sign painting, drafting, mapping, surveying, water purification, supply, plumbing and pipe-fitting, signal communication, gas, weapons, camouflage, company administration, mess management, cooks and bakers, and buglers, all in addition to heavy shop trades. Obviously, the number of men sent to each school and the time spent in the





The soldiers are trained to assemble and erect the standard H-10 portable steel bridge, using a highway cut to simulate field conditions. At the right, trusses for the bridge at the left are being pushed across the imaginary streambed.

schools varies widely. Both officers and enlisted men attend the administration, surveying, demolition, and a few of the other schools. Drafting, mapping and surveying studies are confined to the relatively simple field needs. The mapping school includes use of simple rules for rough determination of bridge capacities, size of waterways, etc. Similarly, in the rigging school, men are taught simple rules for computing the load that can be carried by ropes, cables, booms and masts, and in addition, advanced cable splicing.

Most of the men from specialist companies, such as the dump-truck companies, go through the school for motor mechanics and drivers. The saw-mill and logging schools concentrate chiefly on men from the forestry unit, but a few men in each of the general service regiments are trained to operate the type of portable sawmill that is taken into the field. Also, men in each regiment are given training in more than one trade so that each unit will have replacements for its basic trades.

Salvage and repair is an important part of the training of truck operators. Two poles, chain and the winch line of another truck make a serviceable field hoist.

After working with dummy explosives to learn the technique of demolition, the men are given practical demonstrations of the effect of properly placed explosives.

Bridge building

Emphasis is laid on bridge building, it being made part of the regular training for the great bulk of the men in each general and special service regiment. This includes erection of fixed bridges and portable bridges, also construction on ponton bridges and floating foot bridges, although ponton equipment is not part of the equipment of these regiments.

Timber trestles built by the units are given a severe test under actual tank loading to determine how well they are built. Each unit also is trained in assembly and erection of the army's H-10 portable bolted truss spans. In this bridge-building work, emphasis is laid on coordination and on diversification of training of the individual soldier rather than on speed in completing the task.

Road building

As road and airport repair and construction are expected to form a large part of the work of the general and special service regiments, most of the men are made familiar by observation and by actual training with the simple types of road construction and with emergency methods of providing roads such as corduroying and planking. Training is given in the construction and use of wire corduroy mats, both for roads and footpath, also in the construction of simple log or plank culverts. Methods for filling bomb-craters form a major part of the roadwork training.

By demonstration and practical work the men are made familiar with the major types of tank obstacles. They also are taught to construct barbed wire entanglements.

All men are made familiar with the principal types of booby traps and land mines, and are taught how to make them ineffective. By realistic but quite harmless methods, they are shown how effectively booby traps can be concealed over a variety of field conditions.

Demolition of structures is taught first with dummy explosives and then by actual destruction of wood and

concrete columns, rails, etc. Men in all units also are taught how to destroy their equipment in case it must be abandoned.

Military training

Training in construction operations is supplemented by training of a more military nature designed to insure that each man can take care of himself in the field in case of attack. Most men are armed with a rifle and officers are armed with carbines or pistols. In addition, each unit is equipped with machine guns. All are trained in the use of the type of arms with which they are equipped, in simple tactics, construction of foxholes and simple gun emplacements, and in the rudiments of camouflage. All receive gas training and certain men in each unit are trained in the care of gas masks. Recognition of poison gas and ability to decontaminate areas in which gas has been released is included in the training of this latter group of men.

Training of the first units to be organized in the E.U.T.C. at Claiborne extended over only a few weeks. Now, an effort is made to hold each unit in the center for thirteen weeks or longer if possible. Training of enlisted men in each unit is left in the hands of the unit's officers, the staff of the plans and training unit of the center giving only general training supervision and assisting when necessary.

Brig. Gen. C. L. Sturdevant, Assistant Chief of Engineers (left), congratulates Brig. Gen. John W. N. Schulz, Commanding General of the Engineer Unit Training Center on the progress being made at Camp Claiborne.

As the time for a regiment to leave the camp approaches, its officers and non-commissioned officers are trained in procedure to be followed in moving the regiments from the camp to the port of embarkation. Quite generally, trucks and construction equipment used during the training period at the camp are not taken with the units but are turned back to the equipment pool in the camp. However, some equipment is taken and the units are trained in methods for packing and loading this equipment, the carpenters of the unit being called on to make crates for all equipment that must be packed.

Movement to a port

Officers who will be in charge of the movement are taught how to set up kitchens on the trains to feed the regiment on the move and are instructed as to sources of supply en route, and as to location of hospitals and military headquarters in areas through which they will pass.

All units are under the control of General Schulz, commander of the center, until they reach the "staging area" near the port of embarkation. On arrival at the staging area to await embarkation, they pass from the jurisdiction of the Engineer Unit Training Center at Camp Claiborne.

Forestry units are given practical experience in setting up the type of sawmill that is taken into the field. They cut timber in the forested areas around Claiborne and convert it into lumber for use in the camp.

Air-Inlet Valve Design for Pipelines

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***Contents in Brief**—Air-inlet valves installed on thin-walled, gravity-flow pipelines provide insurance against collapse that might result from the formation of a vacuum. The manner of calculating collapsing pressures in a pipe, and the determination of the size, number and location of valves is outlined. Computations are simplified with the aid of nomographs.*

IN THE DESIGN and operation of large steel pipelines flowing under gravity, consideration must be given to the possibility of collapse in case the internal pressure is reduced below that of the atmosphere.

A number of serious failures have resulted from neglecting to provide against this possibility. The means of correcting such a condition are two: Strengthening the pipe, or providing air inlets. In almost every case strengthening the pipe is the most expensive; therefore, the use of automatic air inlet valves is the logical solution.

If the pipeline runs on a uniform grade from a reservoir to an outlet, and a quick-opening valve is suddenly opened at the lower end (this action being equivalent to a break in the pipe) water will then flow at a uniform velocity caused by the hydraulic gradient, without the existence of a vacuum. For such a case, theoretically, no air inlet valves would be required. However, all pipelines are not laid on uniform grades.

When the slope of the pipeline near the point of the break is greater than the slope upstream, the discharge through the steeper grade will be greater than that through the flatter grade, and therefore a vacuum will occur at some point upstream from the break. If the pipe is not of sufficient thickness, it would be in danger of collapse.

Preventing pipe collapse

Even with a supposedly uniform grade the pipe might be in danger of collapse as the result of irregularities in its grade, and if the pipe is not perfectly round, the danger of collapse is much greater.

Most causes of collapse of thin-walled pipes have been found to be due to a break in the line—with a consequent release of water and the formation of a vacuum at the higher points.

This general rule should be kept in mind: If water in any part of a pipe flows faster than in some other part, a vacuum will occur at the point where the grade is steepest. Even with a uniform grade it is on the side of safety to assume that every part of a gravity line is subject to pressures below the atmosphere.

To determine the size of air inlet openings required to prevent collapse, it is necessary to have the diameter and thickness of the pipeline and a profile. Then assumptions should be made that the pipe might break at any point where the grade changes, and automatic air inlet valves of sufficient inflow capacity should be provided to prevent collapse.

In making these assumptions it is usually proper, in the interest of safety, to disregard the delivery of water from the pipe having the flattest grade because of the probability of conditions existing upstream that would prevent the pipe from flowing at the calculated rate.

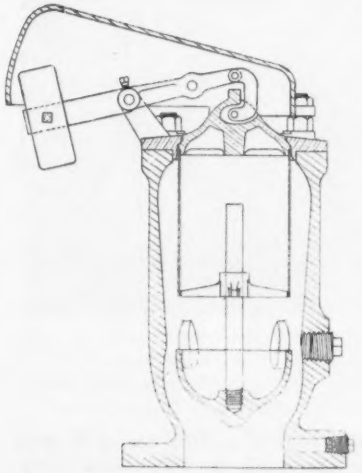


Fig. 1. Details of an air-inlet valve

It is a more practical and economical matter to install a number of moderate-size valves at a critical point than to install one very large valve. Valves of 4 to 10 in. nominal inlet diameter are stock items and are relatively inexpensive when compared with their equivalent in one special valve. The installation of a group of such valves can be controlled by one large gate valve installed between the pipe line and their common manifold casting.

Collapsing pressure of pipe

The collapsing pressure of a cylindrical steel pipe (Reid T. Stewert, *Trans* A.S.M.E., vol. 27, 1905–06, p. 795) is as follows:

$$P = 50{,}210{,}000 \left(\frac{t}{D}\right)^3 \qquad (1)$$

in which

P = collapsing pressure, psi.
t = thickness of pipe in inches
D = diameter of pipe in inches

The maximum collapsing pressure due to a perfect vacuum at sea level (elev. = zero) would be about 14.7 psi. This value would then be the maximum possible differential pressure across the air inlet valve. If no factor of safety were used, the diameter of the air inlet valve would be such to maintain the vacuum just at the point where collapse of the pipe would occur.

Based on past experience a factor of safety of 4 should be used, thus maintaining the vacuum at ¼ the point of collapse and providing insurance against imperfections in manufacture and the possibility that the pipe may not be truly round. It also provides for probable variations in flow coefficients.

Inserting this value in equation (1) we obtain:

$$p = 12{,}552{,}500\left(\frac{t}{D}\right)^3 \qquad (2)$$

where p = safe differential pressure psi.

This equation may be solved by referring to Fig. 2. Connect known value of D and t with a straight edge and read p. If the line intersects the p axis above elevation zero (sea level) no air valves are needed. For elevations other than sea level, no air inlet valves will be needed if the line intersects above the actual elevation. If the intersection is below the line of actual elevation, air inlet valves are needed.

Determining air inlet size

The size of the air inlet is determined according to the following principle: Should air go into a pipe at the same volumetric rate as the water is flowing through the pipe, a vacuum will not occur. According to Chezy's formula, the flow of water in a pipe line may be stated as:

$$Q = 0.0007872C\,(SD^5)^{\frac{1}{2}} \qquad (3)$$

in which

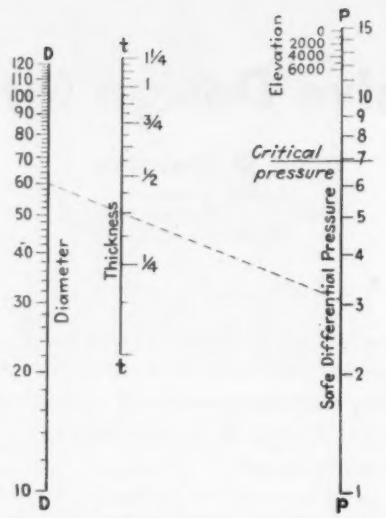


Fig. 2. Collapsing pressure of a steel pipe of known diameter and thickness is obtained from this nomograph. The safe differential pressure provides a safety factor of four.

Q = flow of water, cu. ft. per sec.
C = coefficient in Chezy's formula = 110
S = slope in ft. per foot of length
D = diameter of pipe in inches

The equation for the flow of air through an orifice or air inlet valve (*Fluid Meters: Their theory and operation;* Report of the A.S.M.E. Committee, 4th edition, 1937) may be taken as:

$$w = 0.525\ K\ Y_1\ d^2\ \sqrt{\rho \times p} \qquad (4)$$

in which

w = flow of air, lb. per sec.
K = flow coefficient = $c/\sqrt{1-\beta^4}$
Y_1 = expansion factor
d = diameter orifice inches
ρ = density of air = .0764 at 60°F and 14.7 psi., absolute
p = differential pressure, psi.

In the above, $\beta = d/d_1$ or the ratio of the orifice diameter to upstream diameter. In the case of an air inlet valve the upstream diameter would be very large so the value of β for all practical purposes would be zero. Therefore the value of K would equal c, the discharge coefficient of the orifice, and it can be assumed, as an average value, that $K = c = 0.60$.

An average value of Y_1 has been taken as 0.95.

The equation for determining the critical pressure ratio is:

$$r_c = \left(\frac{2}{k+1}\right)^{\frac{k}{k-1}} \qquad (5)$$

in which

r_c = critical pressure ratio = p_2/p_1
p_2 = downstream pressure, psi, absolute
p_1 = upstream pressure, psi, absolute
k = specific heat ratio = 1.4 for air

substituting the value of k in equation (5)

$r_c = 0.528$

and since $p_1 = 14.7$ (atmosphere)

$p_2 = 0.528 \times 14.7 = 7.76$

and the maximum value of p for equation (4) would be

$p = p_1 - p_2 = 14.7 - 7.76 = 6.94$ (critical pressure)

Substituting the values of K, Y_1, and ρ (and since 1 lb. of air at 60 deg., and 14.7 psi., absolute, equals 13.09 cu. ft.), equation (4) may be written as

$$Q = 1.083\ d^2\ \sqrt{p} \qquad (6)$$

in which

Q = flow of air, cu. ft. per sec.

Combining equations (2), (3) and (6) we obtain

$$d = \frac{D^2}{210.5}\left(\frac{S}{p}\right)^{\frac{1}{2}} \qquad (7)$$

This equation may be used to determine the size of air inlet for all values of p up to and including 6.94. This value is shown on Fig. 2.

For cases where p is greater than 6.94 the critical pressure ratio p_2/p_1 has been passed and it is an accepted fact that the air flow cannot be greater

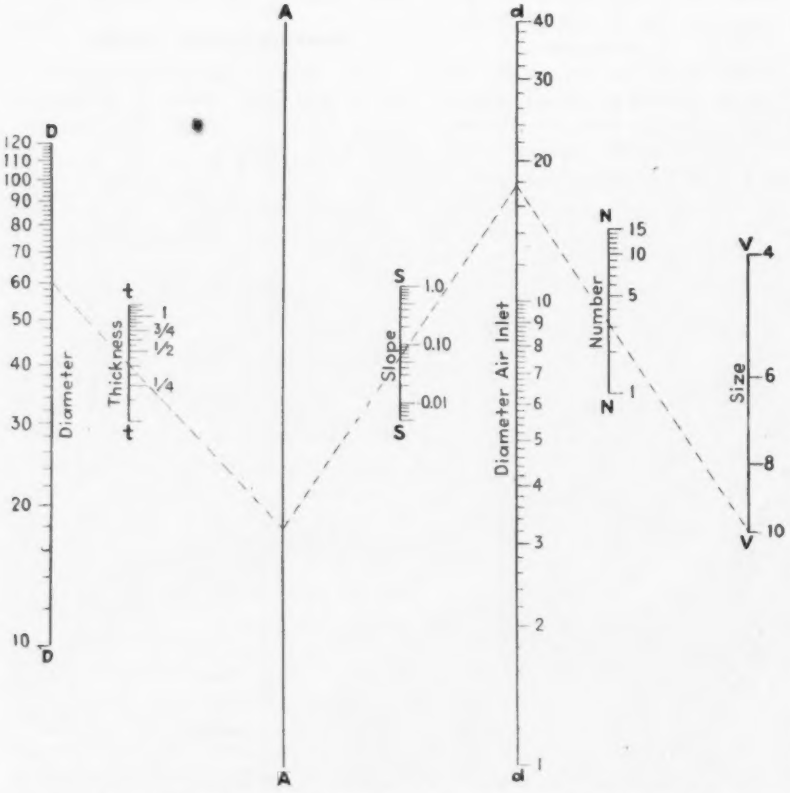


Fig. 3. Determination of the required size and number of air-inlet valves to meet stated conditions of pipe thickness, diameter, and slope, for differentials below the critical pressure.

than that obtained with a differential pressure of 6.94 psi.

Using this value of p in equation (6) we obtain

$$Q = 2.853\ d^2 \qquad (8)$$

Combining equations (3) and (8) we obtain

$$d = 0.1742\ (S\ D^4)^{\frac{1}{2}} \qquad (9)$$

This equation may be used to determine the size of air inlet for all values of p above 6.94.

The flow of air through an orifice also varies inversely as the square root of the absolute temperature, but it should be noted that the flow at a temperature of 40 deg. will be only 6 per cent greater than at 100 deg. Therefore, the changes of temperature need not be considered.

Reference to Fig. 2 determines whether equation 7 or 9 will be used to find the required size of air inlet.

If intersection with the p axis is below 6.94 use equation 7, which may be solved easily by referring to Fig. 3. Connect diameter D and thickness t with a straightedge to secure an intersection on A. Connect the latter point with slope S and find the intersection on d. This gives the diameter of air inlet.

If intersection with the p axis is above 6.94 use equation 9, the solution being given by reference to Fig. 4. Connect diameter D and slope S with a straightedge to secure intersection on d. This gives the diameter of air inlet.

Since the diameter obtained by either of the foregoing equations may not be equal to that of the standard manufactured size of air valve, it is necessary to determine how many valves of a smaller size, installed in a cluster, may be needed to give the equivalent area to that of diameter d. This may be found by connecting the previous intersection on d (either Fig. 3 or Fig. 4) by a straightedge with any of the sizes given and obtaining the required number of valves of this size at the intersection with line N.

A practical application

In order to show the practical application of equation (7) or Fig. 3, let us take a case as shown in the accompanying profile. (Fig. 5A).

Case I—Assume that the pipeline is 60 in. diameter and $\frac{3}{8}$ in. thick, from the reservoir to point C, and that at this point the line breaks, or what is equivalent, a valve is suddenly opened wide with free discharge. The slope S between point A and B is 80/2000 or 0.04 and the slope between B and C is 60/1000 or 0.06. Since the slope of B-C is greater than that of A-B, it is evident that the lower section will discharge at a higher rate than the upper section.

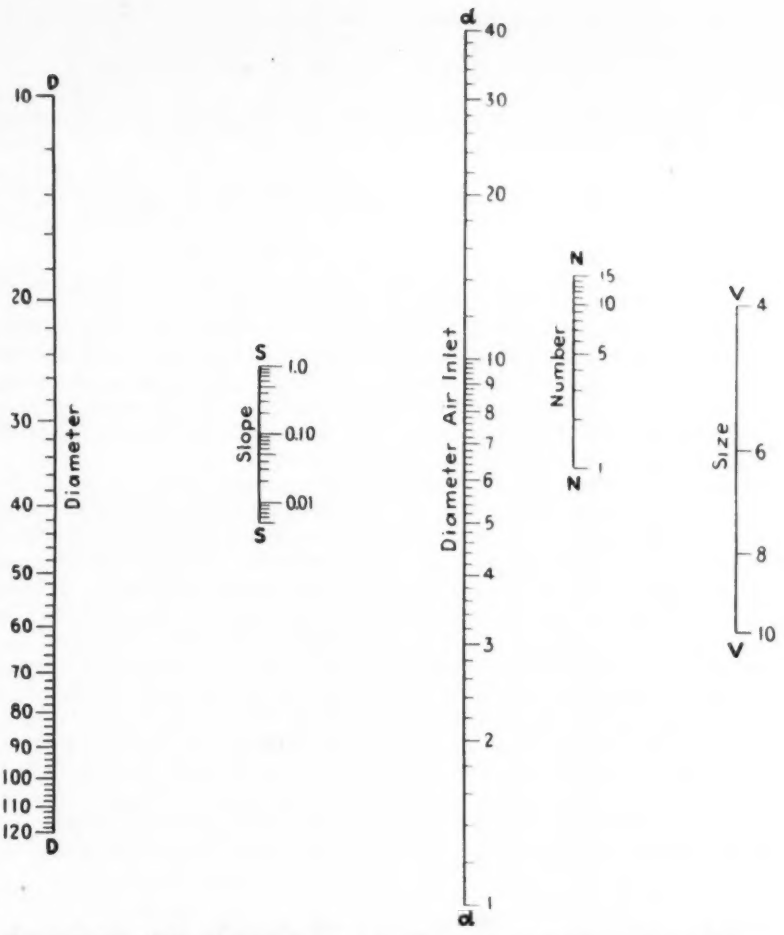


Fig. 4. Determination of size and other characteristics for differentials above the critical pressure

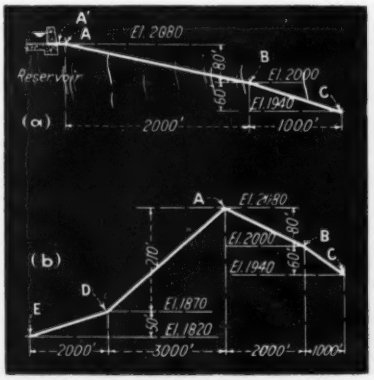


Fig. 5. Pipe profile diagrams to illustrate practical applications of air-inlet valve installations. In the top profile, air valves would be placed at point B, and may be required at point A . In the lower profile, air-inlet valves are required at points A and B

We will first determine if air valves are needed at B to prevent collapse, by referring to Fig. 2. Connect D = 60 with $t = \frac{3}{8}$ by a straight line, which intersects the p axis at 3.06 psi. Since this is below Elev. 2000 air valves are needed, based on equation (7).

To find the size of air inlet refer to Fig. 3. Connect D = 60 with $t = \frac{3}{8}$ to secure intersection with line A. From this intersection through S = 0.06 find intersection on line d, or 17.66. This is the diameter of required air inlet. Since this diameter is larger than the 10 in. valve, and bearing in mind that two or more smaller valves are better than one large valve, we will determine the number of smaller valves that will have the equivalent area due to diameter d.

From intersection on line d (17.66) draw a straight line to either 4, 6, 8

or 10 on line V. Find number of valves required on line N, which would be:

Size of Valve	*Number Required*
4 in.	19.49
6 "	8.67
8 "	4.87
10 "	3.11

From an economic standpoint the use of three 10 in. valves—placed at point B in the line—would be recommended, since a smaller number of large valves would cost less than a larger number of small valves and the installation cost also would be less.

In the above example, no air inlet valves are needed at point A since the line is supplied by the reservoir and would always run full, even if a break occurred at either B or C.

If a valve should be present in the line at point A′ and this valve is closed, then air valves are needed at this point to prevent collapse, should a break occur at points B or C, or should the valve A′ be closed while water is flowing. Although the slope of A′-B is 0.04, the induced slope with a closed valve would be 140/3000 = 0.0466. Again referring to Fig. 3 we find the diameter of air inlet for a slope of 0.0466 would be 16.58 and that three 10 in. valves would be required at point A′.

Case II—In the profile, Fig. 5B, the line A-B-C is the same as given in Case I, but A is now a summit, the line leading up from E to A and down to C. We will assume that this line is the same size and thickness as that given under Case I.

No air inlet valves will be needed at point D since with a break occurring at E the slope of E-D is 50/2000 = 0.025 and that of D-A is 210/3000 = 0.07. To determine the size of air inlet at A we must consider that a break may occur at either E, D, B or C.

If the break occurs at E, the induced slope E-A would be 260/5000 = 0.052, at D the slope of line D-A is 210/3000 = 0.07; while the slope of A-B is 0.04, that of B-C is 0.06, and the induced slope of A-C is 0.0466 as in Case I. Therefore, the size of air inlet at A will be determined by a break at D since the slope of D-A is the greatest in the system.

By referring to Fig. 3 we find the size of the air inlet to be 18.35, and that four 10 in. valves are required.

Therefore, for this situation we should install four 10 in. valves at point A and three 10 in. valves at point B.

For cases where the diameter and thickness of the line give an intersection of the *p* axis (Fig. 2) above 6.94, but below the given elevation. Use Fig. 4 to determine the size of air inlet and the required number of valves by the same method.

Conclusion

It will be found that the information contained in this article will be of value, not only by definitely indicating the number, size and location of the air inlet valves on existing pipe lines, but also to the design engineer in determining the required thickness for new lines. If the number and size of air inlet valves determined are excessive for a particular section (steep slope) with a given thickness, it is plainly shown that this section should be thickened in the interest of safety, while with the adjacent sections the given thickness may be satisfactory.

The writer acknowledges with appreciation pertinent information used in the preparation of this paper from William S. Pardoe, professor of hydraulics at the University of Pennsylvania.

War Demands Force British to Adapt Trucks for Bulk Cement Delivery

War demands for greater delivery of cement than ever before, plus restrictions on drums, paper and jute for packaging has led to wide scale use of bulk cement in Great Britain.

From May, 1942, to Jan., 1943, the Ministry of Works in England delivered 210,000 tons of bulk cement to 34 projects with American-made trucks. A total of 1,400 tons of paper and much time and labor was saved by the short-cut method.

Before the war, cement was packed either in drums or in paper. Drums were used only where special protection was needed and paper for most inland deliveries. When paper became difficult to obtain, jute was adopted as an alternative packing material.

Since 1941 the British government has been especially interested in American methods of handling bulk cement with pumps and by other means, but machines from the U. S., and spare parts, could not be made available in sufficient quantities for the need.

A few 12-ton trucks with articulated chassis were available on lease-lend, and these were assigned to bulk cement handling. Specially constructed steel tank bodies with four 9 x 18-in. side-doors sealed with canvas strips were mounted on these chassis.

To provide a reserve to keep the big central mixing plants in continuous operation on airbase projects a light receiving shed was erected to house two 30-ton bins built of brick. From the bins cement was delivered to the boot of an elevator driven by an independent oil engine, the elevator in turn delivering into the feed of the mixer. To discharge into the bins, the lorry was run up a slight ramp, and guided into position by concrete curbs. By attaching an unloading chute to each of the four doors, a truck could be emptied in 20 min. by four men.

To avoid dependence on a small oil engine and conveyor for continuous operation, a ramp was arranged so that the trucks could feed the mixer by gravity. Deliveries varied from 2,000 to 6,000 tons per week.

Later 120 five-ton American trucks with short chassis were obtained. They included 90 dump-bodies and 30 tank bodies fitted with doors interchangeable with those on the 12-ton trucks already in use. Tarpaulin covers were provided as was a special cam action tailboard, fitted with rubber joints. In the tailboard were built two 6-in. feed valves with a sliding steel cutoff, and on which could be clipped a canvas trunk. In this way the same lorry could dump direct into the hopper where there is a central mixer or provide a controlled feed into a small portable mixer. It was found that the 6-in. feed valve was too small, and subsequent lorries were equipped with a 9-in. valve.

War-Training Programs Take Spotlight At Engineering Educators Meeting

***Contents in Brief**—The Society for Promotion of Engineering Education centers its 50th annual meeting on the engineer training programs for the Army and Navy that are now being started in most of the engineering schools of the country. Students in the military services will get academic credits for most work. Teaching load believed to be too high under the program as now set up.*

CONDUCTED strictly as a wartime convention, the 50th Anniversary Meeting of the Society for the Promotion of Engineering Education, held in Chicago, June 18-20, was devoted primarily to questions raised by the intensified training of students for the armed forces and war industries. The operations and aims of the several specialized curriculums advocated by the Army and Navy in their intensive training courses starting next month were covered in considerable detail by officers from the two services. Another feature of the meeting was postwar planning for the training of students in the transition from war to peace.

Specialization needed

In welcoming the 750 delegates to the three-day meeting, Franklyn B. Snyder, president, Northwestern University, stated that no one can quarrel with the present ultra-specialization in technical training, but he warned that "the pendulum may very well swing to the other extreme after the war, with over-emphasis being placed on the so-called liberal education studies." However, he continued, there must always be the exact training that is given in scientific and engineering courses, since the world has need of men of "exact minds". President Snyder challenged the society to foster development of intellectual courage comparable to the physical courage now being shown by so many young Americans all over the world.

A comprehensive report on the aims and activities of the Army Specialized Training Program was presented by Col. Herman Beukema, director of the program. Said Col. Beukema, "arrangements are being made to train youths under 18 who qualified for the program in screening tests conducted in high schools and colleges throughout the nation last April". "Now," he continued, "the Army plans to establish an agency to determine where talented soldiers in limited service may best be utilized, with a view towards placing some of them in war industries". Qualified youths under 18 will be given advanced training but will remain civilians until their 18th birthday, he said.

Reclassification of men

In reviewing operations of A.S.T.P., Col. Beukema remarked that the program was inaugurated last December, with specifications to govern it being obtained from chiefs of the several Army services. Advice as as to its operations were secured from the American Council of Education and from a board of ten college heads that acts as an advisory committee. Service men eligible for training under the program, as determined through a screening process of country-wide tests, are reclassified by certain especially selected colleges, designated as Star colleges in the program. At present there are 15 Star colleges and that number is to be increased to 27, said Col. Beukema. Refresher courses are offered at these Star units to provide such additional minor education as may be found lacking in an otherwise well-qualified candidate for A.S.T.P. training.

Col. Beukema forcefully brought to the attention of the assemblage that the primary purpose of this training plan is to have soldiers in uniform on campuses, and not merely to have college men in uniform. No man, said Col. Beukema, "owes his country any less than the fullest use of his best qualifications". The acute need for A.S.T.P. training is quite apparent since two out of every three men in the army engineers must be specialists, according to Col. Beukema. The rapid growth of the program is shown by the fact that on March 6, 1943, there were no trainees enrolled, but by July 24 there are expected to be 45,000 trainees enrolled under the classifications of basic trainees, engineering, language and area, and psychology. Also, at that time there are expected to be 22,000 medical trainees, he said.

Navy V-12 program

Dean Joseph W. Barker of Columbia, now special assistant to the Secretary of the Navy, reported on special naval training programs and in particular upon the recent developments centering in the V-12 program. He explained that the allocation of colleges was arranged by a joint committee representing the Army, Navy and War Manpower Commission. In the selective examination of last April, 160,000 of the 300,000 specially qualified high-school boys taking the test had indicated a preference for the naval service. Of these, 30,000 have been selected for the V-12 program and will soon be at the selected institutions. They are to be provided with clothes, books, board, and $50 per month spending money—the latter provision being one that may lead to difficulties in discipline, according to Dean Barker. Local commanding officers on each campus will have to face such difficulties if they arise as the college authorities will be responsible for the academic work only. In academic matters, college authorities will have full authority. Instruction is to be given on the basis of 20 to 30 students per section and a maximum teaching load of 20 contact hours per week for each staff member. Contractural arrangements with

colleges are to be the same for Navy and Army programs.

Later in the meeting it was announced by D. B. Prentice that the committee on Engineering schools of the E.C.P.D., had approved the Army and Navy programs at accredited institutions as counting towards academic credits on the basis of the time actually spent at work. On the other hand, the committee did not approve the proposed staff teaching load in view of the fact that the special courses are to be operated continuously.

Special training programs

Relationships between the War Manpower Commission and the engineering colleges were discussed by W. W. Charters, director, Bureau of Training, WPB. In a review of special programs of war training, there are five concepts being given a workout, said Mr. Charters, but they will not necessarily be continued after the war. These concepts are: (1) "specificity"—training to do specific operations on specific machines in order to increase production on assembly lines; (2) "intensity of instruction"—acquiring of more learning in less time by adopting accelerated curriculums requiring harder work and also by spending more time in school: (3) "interest of students"—increase in interest of the student spurred on by the impetus of war conditions; (4) "new methods of instruction"—more production is being accomplished in less time through the increasingly popular specialized methods of instruction given under the Training Within Industry program; (5) "flexibility"—the ease with which courses and methods of training are changed to accommodate requirements of different groups.

Some of the methods employed in the present Engineering, Science, Management War Training program should be preserved for peace times, said Mr. Charters, and he strongly urged the appointment of a committee of the S.P.E.E. to study these methods, now being used under war impetus, with a view towards utilizing everything good that comes out of war training for peace time.

Armed Forces Institute

In discussing the activities of the United States Armed Forces Institute, Col. Francis T. Spaulding, chief of the special service division of the education branch of the Army, reported that members overseas apparently are more eager to continue their education than are those stationed within the continental United States. Although operating strictly on a correspondence basis, the value of the institute has been widely demonstrated by its increasing enrollments, said Col. Spaulding, with enrollment during recent months holding at 1,500 per week.

The work of the institute is based upon recommendations made about a year ago by a special committee of the American Council on Education. Recommendations of that committee were three-fold: (1) that the kind of blanket credit for military service offered by many schools and colleges in the last war be voided; (2) that the Carnegie-unit system of crediting educational achievement in the service be recognized as in most instances both impractical and invalid; (3) that in place of the Carnegie-unit system the armed forces be asked to supply dependable data as to the student's educational growth while in service, on the basis of which colleges may be able to judge their educational maturity as well as their achievement in specialized fields of study.

Things to come

Temporary governmental support of educational institutions as a part of the rehabilitation program for returning soldiers was predicted by Karl T. Compton, president, Massachusetts Institute of Technology, who also expressed the belief that colleges and universities will face large enrollments during the first three years following the war because of an influx of homecoming fighters together with incoming younger students. The cost of completing the education of the men whose schooling was interrupted by the war would be no more than the cost for their care in other ways, said Dr. Compton. Other predictions of Dr. Compton regarding the future trends in engineering training were: (1) graduate work will increase relatively, with more attention being focused on research; (2) there will be an increase in the tendency to build up engineering staffs as coordinated teams by dint of drawing upon the fields of physics and mathematics as well as from engineering; (3) engineering education must be adapted to development along research lines or else the field will be invaded by scientists; (4) immediate postwar training must be made flexible to allow for substitutions in curriculums to fit the needs of returning soldiers and the youngsters.

Progress in education

In reviewing the progress of engineering education during the past 50 years, H. P. Hammond, dean of the School of Engineering, Pennsylvania State College, cited the five basic characteristics that have continued to be foundation stones on which the structure of engineering education is based. These are: (1) maintenance of the unified type of program based on secondary school preparation and leading, upon graduation, either directly to industrial employment or to further study at the postgraduate level; (2) subdivision of the curriculum into three parallel major stems of the basic sciences, the humanities, and the professional engineering courses; (3) the rigor of instruction and objective of standards; (4) the use of three complementary methods of instruction—lecture and recitation, design, and laboratory practice; (5) the concept of professional aims.

Anniversary features

Significant features of the meeting included a commemorative church service at which the sermon was preached by Rev. Harrison R. Anderson, himself a graduate engineer, on "Wanted—A New Engineer." On Sunday morning, June 20, four senior members of S.P.E.E. participated in the Northwestern University radio presentation "The Reviewing Stand," discussing the relation of engineers to the present emergency, and future prospects in engineering developments; participants were W. E. Wickenden, H. T. Heald, Karl T. Compton, and O. W. Eshbach. At the annual dinner of the society, an address was given on Engineering Education in Modern Russia by Dr. J. G. Tolpin of Universal Oil Products Co., Chicago; the Lamme Medal was presented to Thomas E. French; and certificates of charter membership were presented to F. E. Giesecke, D. C. Jackson, and R. L. Sackett—three of the seven original members still living. R. E. Doherty, president of Carnegie Institute of Technology, Pittsburgh, was elected as president of the society.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Corrugated Pipe Sewer Carried Across River on Bridge

To connect new sewers in South Danville, Ill., with a main trunk sewer in Danville an uncommon crossing over the Vermilion River was constructed recently. An inverted siphon was considered unsatisfactory, as was the plan to cross the stream at river bed level and to pump the sewage to the desired elevation. The final plan was to suspend a 10-in. dia. gravity line from an existing 1,700-ft. long railroad bridge, which is 120 ft. above the river and has plate girder approaches to the deck truss river span.

Corrugated metal pipe was selected for the crossing because of its ability to absorb expansion and contraction without any special fittings. Also, the pipe is of light weight and could be easily coupled.

To suspend the pipe from the girders without drilling holes in the structural members the hanger illustrated by an accompanying drawing was developed. In order to maintain a uniform grade on the sloping approaches, threaded rods were used for the vertical supports. Where long rods were required, horizontal ties to the bridge were made to take care of wind loads. Near the discharge end, the pipe is carried well to the side of the supporting girders and steel cables were added for additional support to the angle iron brackets. An accompanying picture shows the method of support near the abutment.

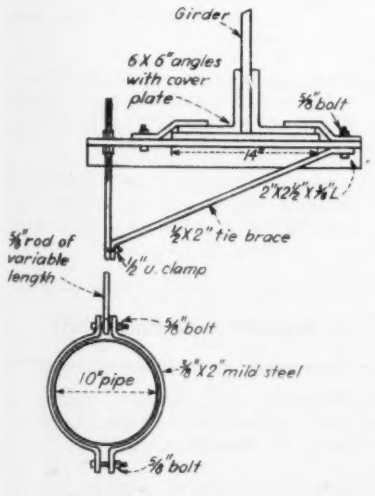


Fig. 1. Close-up of the support employed where the sewer was suspended from the deck girder as shown in Fig. 2.

Fig. 2. To suspend a corrugated metal pipe sewer from an existing bridge, the above hangers proved satisfactory.

Pipe fabricated in 24-ft. lengths

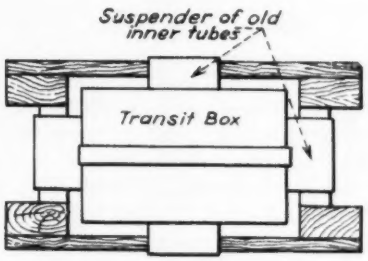
The pipe was fabricated in 24-ft. lengths with standard 12-in. wide corrugated coupling bands. Both the pipe and bands received a double asphalt coating. The bands were placed with the opening at the top side and care was taken to see that they fitted tightly. The hangers were on 12-ft. centers with one adjacent to each coupling band and one at the center of each section. A 3.6-percent slope was maintained in the pipe and small elbows were added at changes in line required by the varying width of the bridge and to clear the abutments.

Allan Hickman, Danville, general contractor, installed the sewer in less than 14 days. He used a flat car pulled by a switch engine. A scaffold was suspended from each end of the car by winches. A small hand derrick at the center of the car handled the pipe.

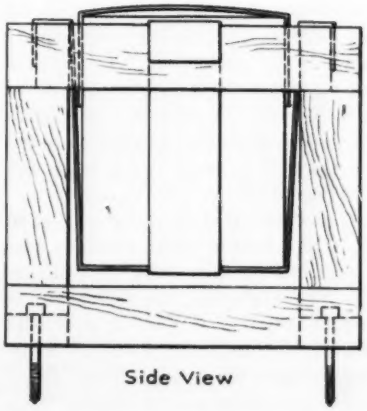
J. E. Epler, manager of the Danville Sanitary District, supervised construction, and Wm. M. Fairhall, formerly engineer for the district, was responsible for design.

Editor's Note: This is an abstract of description by Mr. Epler of the work in *The Highway Magazine*.

An Easily Constructed Transit Box Sling



Top View



Side View

***A SLING FOR PROTECTION** of transits and levels when being transported in the back of a truck may be quickly made from scrap material. As shown, strips of old inner tubes may be suspended from a wooden frame, which is fastened down with bolts or lag screws. Result is a frame that will prevent damage to the surveying instrument.—**DRAKE P. DALE**, civil engineer, Clarion, Iowa.*

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Soil Mechanics Theory

THEORETICAL SOIL MECHANICS—By Karl Terzaghi, 510 pp. John Wiley and Sons, New York; Chapman & Hall, London. $5.

LONG awaited by engineers, Karl Terzaghi's first major book in English is at last available. And, as was to be expected from so eminent an author, the volume is a masterly work.

The title of the book, however, must be carefully noted. Never has one word in the title of a technical book been more significant than "Theoretical" in this case. The book is confined solely to the theory of soil action. It contains nothing dealing directly with the physical characteristics of soils, nothing about the practice of soil testing, and little about the application of the results obtained by theory in the everyday practice of civil engineering.

These comments are made in no critical sense but in order accurately to describe the volume and to indicate to whom it will be most useful. Dr. Terzaghi promises a companion volume on "the properties of real soils and the performance of soils under field conditions." Anticipating questions as to the advisability of so theoretical a volume, the author says in the preface that the readers of his book "will be less likely to succumb to the omnipresent danger of unwarranted generalisations based on inadequate data." Here is ground for argument.

The nineteen chapters are arranged in four sections dealing with: (A) General Principles; (B) Conditions for Shear Failure; (C) Interaction between Soil and Water; and (D) Elasticity Problems. Unusual headings include "Arching in Ideal Soils" as the first chapter in Section B, "Capillary Forces" in Section C, and "Theory of Elastic Layers and Elastic Wedges on a Rigid Base" in Section D. The fact that these subjects demand whole chapters will indicate clearly the extent to which the study of the mechanics of soil has now progressed. Especially to be welcomed are chapters dealing with vibration problems (a subject upon which all too little has been written), the mechanics of drainage, and anchored bulkheads. Treatment of the last mentioned subject is brief in view of the steadily increasing use of this type of bulkhead wall. Discussion is limited to vertical bulkhead walls retaining ideal sand, and so includes little that is new. It would have been helpful if the author had discussed bulkheads retaining clay, a subject upon which practically nothing has been written.

Similar comments could be made with regard to other sections, each reader finding a lack of balance with respect to subjects in which he is specially interested. So wide is the range covered, however, that all such opinions would probably be found to give as their average the arrangement adopted by Dr. Terzaghi. Suffice it then to say that this one volume contains a lucid analysis of all the leading problems involving soil action, well illustrated by good diagrams, and adequately supported by a useful bibliography.

Here, then, is a volume that will probably take its place amongst the classical civil engineering texts in the English language. For the expert in soil mechanics, it will be an invaluable guide. To the graduate student, it will give inspiration and invaluable suggestions. To practicing engineers it will make a varying appeal—great, to those mathematically inclined and familiar with the elements of soil mechanics; negligible, to those to whom soil is still dirt and soil mechanics just another unwarranted intrusion of the classroom into the construction job.

It is instructive to contrast this 500-p. volume with the slim pamphlet containing the reprints of Dr. Terzaghi's first articles in *Engineering News-Record* (1925). The progress made in the intervening years has probably rarely been equalled in any other branch of applied science. It is even more than instructive to contrast the title and nature of this volume with a statement made by the author when opening the First International Conference on Soil Mechanics and Foundation Engineering in 1936, a statement made with all the authoritative vigor of which Dr. Terzaghi is such a master—"As soon as we pass from steel and concrete to earth, the omnipotence of theory ceases to exist. . . . Owing to these [practical] factors, the possibilities for successful mathematical treatment of problems involving soils are very limited."—*Reviewed by* ROBERT F. LEGGET, *Assistant Professor of Civil Engineering, University of Toronto.*

New Engineering Books

THE NEW PHILOSOPHY OF PUBLIC DEBT—By Harold G. Moulton. 93 pp. The Brookings Institution, Washington. $1.

ANALYSIS OF WATER AND SEWAGE—A Laboratory Maunal for Chemical and Bacterial Analysis: Third Edition. By Frank R. Theroux, Edward F. Eldridge, and W. LeRoy Mallmann. 264 pp. McGraw-Hill Book Co., New York & London. $3.

THE MUNICIPAL YEARBOOK, 1943—Edited by Clarence E. Ridley and Orin F. Nolting. 596 pp. The International City Managers' Association, 1313 E. 60th St., Chicago. $8.50.

PUBLIC WORKS ENGINEERS' YEARBOOK, 1943—American Public Works Association, Chicago. 333 pp. $3.75.

SIMPLIFIED DESIGN OF REINFORCED CONCRETE—By Harry Parker. 244 pp. John Wiley & Sons, New York and Chapman & Hall, London. $2.75.

PLUMBING PRACTICE AND DESIGN: VOLUME II—By Svend Plum. 308 pp. John Wiley & Sons, Inc., New York and Chapman & Hall, London. $4.50.

GEODETIC CONTROL SURVEYS—By H. O. Sharp. 124 pp. John Wiley & Sons, Inc., New York and Chapman & Hall, London. $3.50.

ENGINEERING DRAWING: Practice and Theory—By Isaac Newton Carter and H. Loren Thompson. 400 pp. International Textbook Co., Scranton, Pa. $3.

ELECTRONIC CONTROL OF RESISTANCE WELDING—By George M. Chute. 383 pp. McGraw-Hill Book Co., New York and London. $4.

Reports and Pamphlets

PROCEEDINGS OF THE ANNUAL MEETING—American Institute of Consulting Engineers. 75 West St., New York.

CONNECTICUT—Biennial Report of the Highway Commissioner, years ending June 30, 1941 and 1942.

(Continued on page 128)

Engineering Design
—Creator of America's Mechanized Might

In war, as well as in peace, the design engineer is the vital link between the inventive mind and the mass-production reality

IT IS gratifying and interesting to note that reports of new "secret weapons" not only have reversed their course during the past few months . . . they also have increased in frequency. Once they filled us with dread and misgiving. Today the enemy does the worrying.

Word about the latest new Army weapon reached us as this was being written . . . a 2½ ton truck that performs on water as well as on land with equal efficiency. "The Duck", resembling an overgrown amphibious jeep, is particularly suited to landing operations where docks are lacking. Loaded with 20 fully equipped soldiers or their equivalent in supplies, its propeller runs it ashore. It climbs the beach on its six-wheel drive and continues the trip on land.

This important addition to our "second-front" fighting equipment, coming so close on the heels of the now famous tank-killing "Bazooka", is one of many history making contributions of American design engineers — the men who transform nebulous ideas into practical realities — the men who make our war machines superior to those of our enemies.

Invasion and eventual victory became a certainty as soon as America's design engineers threw their full effort into the war against aggression. Adapting intricate ordnance designs to mass production, these men developed weapons such as the M-10 destroyer of Rommel's tanks and brought out the new fighting planes and bombers that have won the air superiority that has turned the tide against the Axis. Taking ideas and giving them form, selecting the materials of construction, deciding upon the method of fabrication, adapting the electrical and mechanical parts that power the product, specifying the finish that protects and beautifies it . . . these men are the focal point of American production. Their ingenuity has no parallel. Once they put automobiles on a mass production basis and within the reach of all. Today, after less than three years and with little previous experience in armament design, they have brought America's war weapons to the highest efficiency . . . surpassing Hitler's weapons despite all the vaunted scientific wizardry of the Germans and their ten year start.

At this point it is well to remember that while Germany's military might is traceable to its superiority in armament, many of the basic technological discoveries (including the airplane and the submarine) are the products of American genius. The Germans always have been aware of the military advantages of technological superiority and have forced its expansion with all their might. They knew that mobility and surprise play a decisive role in modern warfare and their design engineers were kept busy, with unique intensity, to achieve unprecedented results in fast-moving, hard-hitting fighting equipment. Our own military and industrial engineers did not go into action until it became certain that we would be involved in the conflict. But even before our country actually embarked on its Preparedness Program they were busily engaged in developing the designs of our war equipment. Tanks, planes, guns, ships and hundreds of other apparatus and machines of war were studied. Carefully selected committees of our national engineering societies were organized under the leadership of the Army Ordnance Department to serve as advisors and consultants in the development of advanced designs of tanks and other motorized equipment of war. The above mentioned "Duck" and the now famous Sherman tank are just two of the many results of these efforts.

After the Preparedness Program had officially been launched and Congress had made its initial appropriation, it was necessary to create the manufacturing blueprints from which the engines of war could be built. Because the designs of the machines of production, as well as the designs of the products themselves, determine the speed and economy with which anything can be manufactured,

This is the thirteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

the capacity of our industrial system is dependent, to a considerable extent, upon the ability and ingenuity of American design engineers. Germany's military might was successfully mechanized because Germany, for more than 10 years preceding the war, was riding the wave of a world-wide technological revolution. This revolution was as far-reaching as the advent of the electric motor and the internal combustion engine. It was born of the profusion of inventions and discoveries since the last war. German design engineers took advantage of every one of these.

If we are to defeat our enemies and if we are to continue to play the leading role in the post-war world we must make better use of the new technology than do our enemies. The job is up to American product engineers who already have made tremendous strides in designing the intricate machinery of production and of war equipment. Much remains to be done however.

It has been said that the Germans have not developed one single item that can be classified as basically original, nor are there indications that any so-called "secret weapon" will henceforth be developed by them. Today the Nazis are completely outclassed by the tremendous manpower of engineering brains that is at the disposal of American industry. Although we were faced by the same fundamental problems of shortages in materials, manpower and time, our engineers not only solved these problems quickly and effectively, but they outstripped the enemy by the preponderant weight of talent which we were able to bring to bear upon our problems. As is evidenced by studies of the designs of captured German war equipment, our airplanes are faster, carry heavier loads, have superior protective armor and heavier armament. Our tanks, especially the Shermans, stand unmatched. Our tractor-mounted artillery excels theirs in fighting power. Our automotive vehicles are the envy of the world. Our battleships are supreme. Our signal and detection devices are frustrating all of our enemies' attempts to dominate the seas.

And as we approach the end of the conflict, the pattern of which already has been set, the forces that converted American industry from peace to war-production will again be brought into play, and the product engineer will continue to be the fulcrum. Our post-war industry will grow from his blueprint. Nor will his job be any less urgent, any less responsible, any less sweeping in its effects than were his efforts during the war-preparedness program.

Since the cessation of the manufacture of peace-time goods, many new materials and production techniques have been developed. Plastics, synthetic rubber and magnesium in the field of materials were relatively new and restricted in their uses when war came. So were powder metallurgy, induction heating, electrostatic heating, adhesives for joining metals and compressed resin-impregnated wood. The new possibilities in product design created by the electronic devices and applications developed during the war period virtually stun the imagination and the "atomic revolution" promises to change the entire pattern of manufacturing operations.

Never before has there been so much speculation about the future as there is today. Looking forward, who can doubt our limitless capacity to continue our industrial world leadership?

While no one can predict developments in product design in the post-war period, certain it is that they will be so vastly different and so far superior to existing designs that they will obsolete most products as we know them today. With engines of vastly superior metals, designed to burn 100 octane gasoline and built to a precision ten times greater than that of pre-war engines, our post-war automobiles will give from 40 to 60 miles to the gallon. Tires will last from forty to fifty thousand miles. The comfort and smoothness with which these cars of tomorrow will glide along are undreamed of today. Polaroid windshields will eliminate the glare of oncoming headlights and the driver will need to give but scant attention to the manipulation of his simplified gear shifts.

According to no less an authority than Igor Sikorsky, we stand on the threshold of a new air age in which the helicopter will contribute to the greatest prosperity we have ever known.

Prophecies are hard to make at a time like this but speedy house building seems to be a certainty in the world of tomorrow. Air conditioning, new methods of heating, humidifying and drying, promise to be necessities in the post-war home. Vacuum sweepers will be much lighter, less noisy and easier to manipulate. Washing-machines will be fully automatic and practically free of noise and vibration. Not only will our homes and most of the furnishings be of radically new design, but so will the factories and machines that produce them.

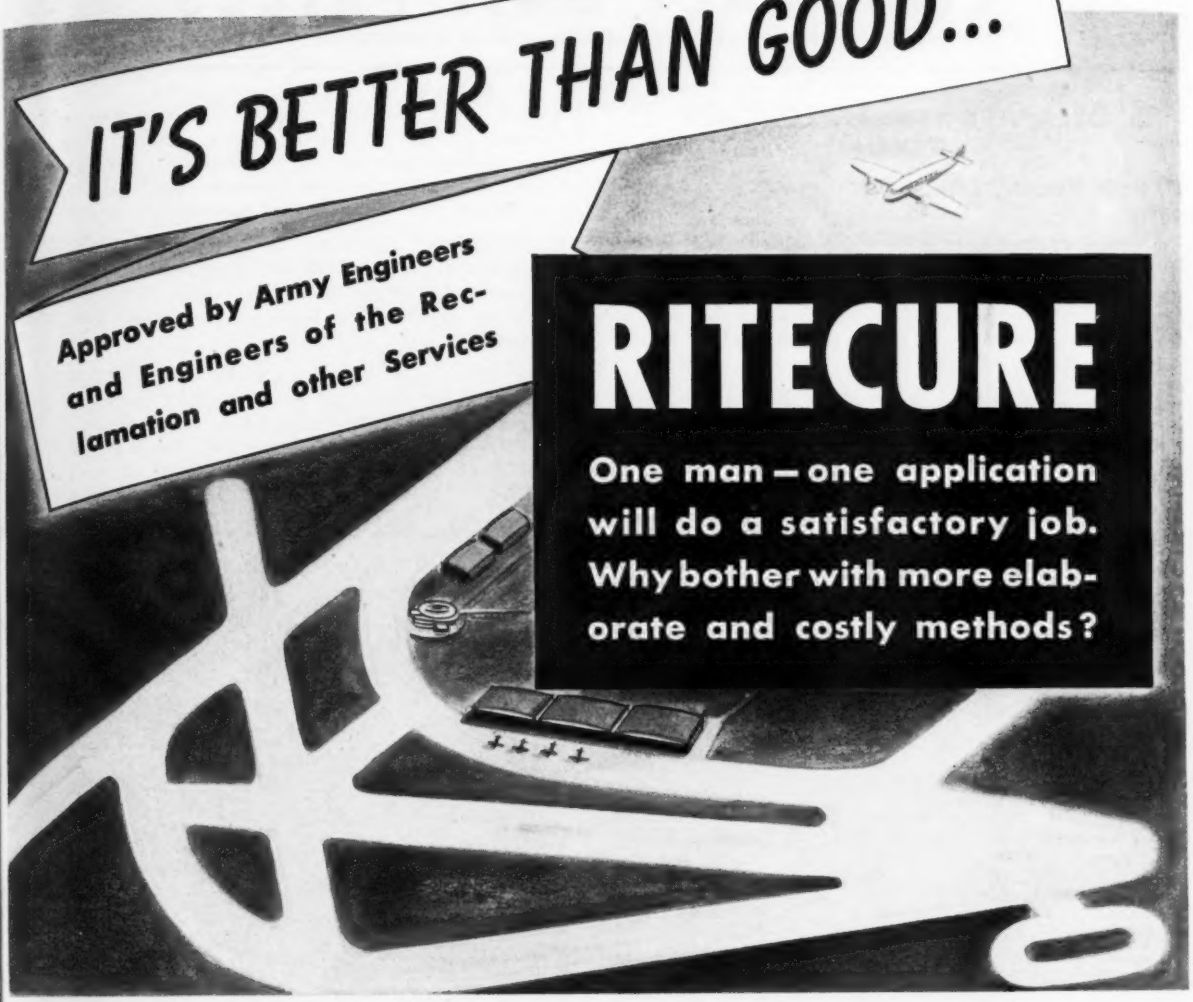
Only one factor can prevent the fulfillment of the dreams of the product designer. His job is not accomplished overnight. To convert sound ideas into production blueprints involves a great deal of time and money. The building of test models is an expensive and tedious procedure. An abundance of seed money is required to perfect the product, to develop mass-production methods and to bring it to fruition as a finished saleable product.

It is the patriotic duty of every industrial leader to hasten these developments so that the material benefits created by them may speed our progress along the road to abundance.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

IT'S BETTER THAN GOOD...



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CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

OVERPASS AND APPROACHES WYOMING

OWNER: Wyoming Highway Dept., Cheyenne.

PROJECT: Construction of overhead crossing over Union Pacific Railroad tracks near Baxter, Wyo., including dismantling, removal and re-erection of portions of existing Ozone Viaduct; and grading, draining, base course surfacing, oil treatment by road-mix method, and other incidental work on bridge approaches on 0.442 miles of Rock Springs Airport Road in Sweetwater County.

CONDITIONS: Contractor to furnish all materials except 45 tons of steel and 15.5 M ft., bm. of treated timber, which are salvaged materials and to be obtained from existing but now abandoned structures. Contractor to dismantle these structures and haul necessary materials to new bridge site. Haul on steel is 250 miles; and on timber is 85 miles. Rail and highway transportation facilities available, and project is to be completed in 150 working days commencing 20 days after notice of award. Minimum wages are: skilled labor, 85c. to $1.20 per hour; semi-skilled, 70c.; and common, 65c.

BIDS: Five bids were opened April 13, 1943, ranging from the contract low of $79,932 to $121,098.

LIST OF BIDDERS:

1. Woodward Construction Co., Rock Springs, Wyo. (contract) $79,932
2. E. E. Peterson, Casper, Wyo 91,376
3. H. W. Read, Cheyenne, Wyo 92,588
4. Northwestern Engr. Co., Rapid City, S. D 97,753
5. Blanchard Brothers, Cheyenne, Wyo 121,098

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation	158,000 c. y.	$0.14	$0.165	$0.20
2. Cubic yard mile haul	57,000 c. y. mi.	.145	.20	.15
3. Watering (embankment)	1,800 M gal.	1.25	2.50	3.00
4. Sheepsfoot roller operation	1,050 hr.	3.75	3.50	3.00
5. Pneumatic-tired roller operation	50 hr.	4.50	6.00	4.00
6. Excavation for pipe culverts	110 c. y.	1.50	2.00	1.50
7. 30-in. corr. metal pipe, installed	276 l. f.	1.00	1.00	1.00
8. Mechanical tamping	95 hr.	4.00	4.00	2.00
9. Class I riprap	5 c. y.	6.00	6.00	5.00
10. Grouted riprap	10 c. y.	10.00	15.00	7.50
11. Guide posts	192 ea.	2.85	2.50	4.00
12. Timber project markers	1 ea.	15.00	15.00	10.00
13. Fit run gravel base crse. (3-in. max.)	3,100 ton	.90	1.15	1.05
14. Crushed gravel base crse. (1-in. max.)	750 ton	1.20	1.46	1.93
15. Crushed gravel surf. (½-in max.)	1,100 ton	1.20	1.46	1.93
16. Stone chips	95 ton	3.50	5.00	3.30
17. Base treatment, MC-1	30 ton	22.00	30.00	22.50
18. Seal coat, RC-3	18 ton	22.00	30.00	25.00
19. M. C. liquid asphalt distr., MC-3	75 ton	22.00	30.00	22.50
20. Processing roadway	8,900 s. y.	.06	.07	.08
21. Watering (base)	50 M gal.	1.25	2.50	3.00
22. Roller operation (base)	30 hr.	4.50	5.00	3.50
23. Shaping and tamping curb	2,850 l. f.	.075	.15	.05
24. Shaping and tamping spillway	60 l. f.	1.00	.40	2.00
25. Structure excavation	10 c. y.	1.50	2.00	1.50
26. New structural steel	2,180 lb.	.20	.30	.30
27. New treated timber	40.329 M bm.	200.000	185.00	180.00
28. 4-in. pipe railing	381 l. f.	1.75	5.00	3.00
29. Transite blast plates	230 s. f.	2.00	1.50	1.40
30. Class A concrete	324.7 c. y.	23.65	25.00	24.00
31. Reinforced steel	1,800 lb.	.10	.10	.09
32. Dry excavation for bridges	180 c. y.	2.00	3.00	2.50
33. Salvaged treated timber	15.487 M bm	50.00	50.00	55.00
34. Salvaged structural steel	Lump Sum	3,900.00	2,000.00	1,950.00
35. Removal of Ozone Viaduct	Lump Sum	3,400.00	3,500.00	4,200.00
36. Treated timber piling	2,724 l. f.	1.70	1.80	1.60
37. Remove three timber bridges	Lump Sum	1,500.00	1,200.00	1,400.00
38. Straight curb (concrete)	400 l. f.	1.25	1.25	1.10

AIRPORT IMPROVEMENTS ROCKPORT, TEXAS

OWNER: Civil Aeronautics Administration, Fort Worth, Tex.; W. R. Haron, engr.

PROJECT: Construction of airport in Rockport, Aransas County, Tex., including grading (field excavation), soil blanket, drainage structures, fencing, seeding, ducts, boundary markers, and surface conditioning. Alternates were allowed on paving: concrete pavement, shell base course, or rock asphalt base course. Award was made on basis of latter.

CONDITIONS: Contractor to furnish all materials and complete work in 60 calendar days. Rail and highway transportation facilities available. Wage rates specified as minimums are: skilled labor, $1.50 per hour; semi-skilled, 75c.; and common, 50c.

BIDS: Five bids were received on Schedule I (Grading, Excavation and Drainage) April 20, 1943, ranging from the contract low of $467,115 to $862,442. On Schedule II (Concrete Pavement) bids ranged from $462,000 to $600,600; and on Schedule III from $361,120 to $522,480. List of bidders and their bid prices are shown with each schedule.

Schedule I—Grading, Drainage and Excavation

LIST OF BIDDERS:

1. Heldenfels Bros., Rockport, Tex. (contract) $467,115
2. Holland Page, Austin, Tex. 608,571
3. Brown & Root, Inc., Corpus Christi, Tex. 725,651
4. A. J. Spicer, Oklahoma City, Okla. 847,709
5. McKinney Constr. Co., Marshall, Tex. 862,442

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Grading (field excavation)	600,000 c. y.	$0.39	$0.47	$0.60
2. Blanket, soil 3-ft. thick	200,000 c. y.	.68	.79	.90
3. 24-in. pipe drains, incl. tr. and bkfill	2,700 l. f.	3.75	4.25	7.92
4. 30-in. pipe, as above	330 l. f.	4.50	5.75	10.32
5. 33-in. pipe, as above	420 l. f.	5.00	7.10	10.98
6. 36-in. pipe, as above	1,300 l. f.	6.00	8.30	12.30
7. 42-in. pipe, as above	1,280 l. f.	7.00	10.40	14.28
8. 48-in. pipe, as above	700 l. f.	8.50	14.00	16.92
9. 54-in. pipe, as above	2,090 l. f.	10.50	18.60	18.90
10. Catch basin grates, wood	80 ea.	20.00	25.00	30.52
11. Catch basin grates, concrete	225 c. y.	35.00	40.00	36.68
12. Install headwalls	5 ea.	140.00	75.00	192.00
13. Ditch excavation	71,000 c. y.	.20	.47	.55
14. Seeding	320 acre	8.00	46.00	15.84
15. Fence, Class D	1,000 rod	1.80	5.00	1.38
16. 12-ft. wooden gate	1 ea.	40.00	50.00	79.20
17. 3-in. duct	4,600 l. f.	.50	1.13	.66
18. Boundary markers	49 ea.	35.00	40.00	29.04
19. Concrete (1:2:4 mix)	10 c. y.	35.00	30.00	31.68
20. Conditioning surface	10 ac.	40.00	30.00	26.40
21. Rock riprap	500 c. y.	6.20	9.00	8.58
22. 3-in. soil blanket	50,000 c. y.	.75	.....	1.10
23. Shell blanket, 3-in.	150,000 c. y.	.95	.....	1.32

Schedule II—Concrete Pavement

LIST OF BIDDERS:

1. H. B. Zachry Co., San Antonio, Tex. $462,000
2. Holland Page, Austin, Tex. 506,880
3. Brown & Root, Inc., Corpus Christi, Tex 554,400
4. Heldenfels Bros., Rockport, Tex. 557,040
5. A. J. Spicer, Oklahoma City, Okla. 600,600

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Concrete pavement	264,000 s. y.	$1.75	$1.92	$2.10

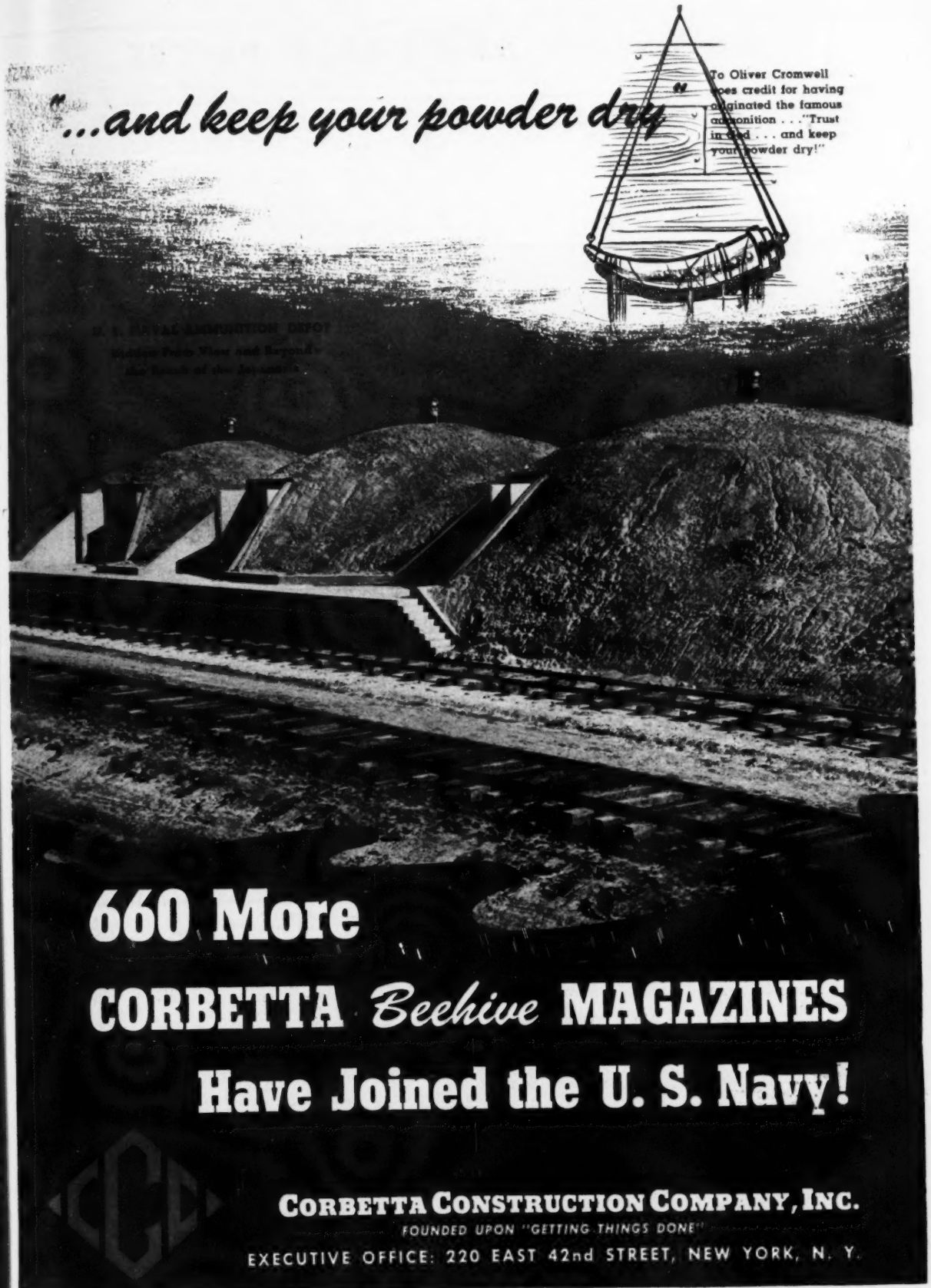
Schedule III—Base Course

1. Heldenfels Bros., Rockport, Tex., (contract) (rock asphalt) $361,120
   (shell) 377,280
2. Holland Page, Austin, Tex. (rock asphalt) 412,040
3. Brown & Root, Inc., Corpus Christi, Tex. (shell) 451,320
4. McKinney Constr. Co., Marshall, Tex. (shell) 522,480

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Base course aggregate	92,000 c. y.	$2.15	$2.54	$2.95
2. Asphalt, base course	100,000 gal.	.10	.11	.13
3. 2-in. surface course, (shell) aggregate	29,000 ton	5.20	No Bid	5.20
4. Seal coat	2,800 ton	4.00	No Bid	2.64
5. Asphalt, seal coat	68,000 gal.	.11	No Bid	.13
6. Asphalt aggregate, 2-in. Uvalde rock asphalt	26,400 ton	5.10	5.50	No Bid
7. Seal coat	2,800 ton	4.00	5.00	No Bid
8. Seal coat, asphalt	68,000 gal.	.11	.12	No Bid

"...and keep your powder dry"

To Oliver Cromwell goes credit for having originated the famous admonition . . . "Trust in God . . . and keep your powder dry!"



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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

JULY CONSTRUCTION material prices and labor rates show only minor changes from the preceding month. Southern pine is mixed in Chicago, up $1.00 on 1-in. sizes, but $1.00 lower on 2-in. sizes; in Philadelphia it is from 25c. to $2.25 per M bd. ft. higher.

A new series reporting concrete block prices is included for the first time and is shown in the table immediately below. This series lists quotations on 8x8x16-in. sand and gravel block and on lightweight aggregate block in truckload lots, delivered in the reporting cities.

Structural clay building tile is lower on the smaller sizes but is up on the larger sizes in Philadelphia. A decline of 3c. per barrel is reported for portland cement in New York, and paving asphalt is off $3.50 per ton in Cleveland. Iron and steel products are unchanged in the twenty reporting cities, except for a 1c. per 100-lb. increase in Minneapolis.

Skilled and common wage rates for construction workers is unchanged in all cities except Atlanta. In that city the structural ironworkers' rate increased from $1.37½ per hour to $1.50.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT Per bbl., C/L lots, incl. 40c. per bbl. for bags, cash dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		CONCRETE Ready Mixed 1:2:4, over 50 c.y., del.
	Cloth *a*	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav.	Lt. wgt. Agg.	
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.50	$1.69	.....	.....	$8.00
Baltimore	2.33	2.08	1.88	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	$0.125	$0.125*w*	7.25
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	.....	5.80
Boston	2.75*b*	2.40*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	.165	.165*w*	7.25*m*
Chicago	2.70	2.45	2.30	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	.16	.16*x*	....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	.12	.15*w*	6.60
Cleveland	2.40	2.15	....	1.70*i*	1.70*i*	1.60*i*	1.70*i*	1.70*i*	1.75*i*	1.75*i*	.14	.14	7.30*i*
Dallas	2.52	2.27	2.07	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	.15	.....	6.20
Denver	3.08	2.88	2.68	1.20	1.40	1.25	1.65	1.75	1.00	1.00	.15	.15*w*	7.25
Detroit	2.39	2.14	1.99	1.65	1.65	1.20	1.63	2.00	2.20‡	2.45‡	.12	.14*w*	6.50
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	.125	.125*wy*	7.50*n*
Los Angeles	2.80*v*	2.20*v*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	.055*bb*	.....	7.25
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.12	.16	7.10*j*
Montreal	....	1.95*rs*	1.79*rs*	....	1.65‡‡	1.30‡‡	1.05‡‡	1.15‡‡	....	....	.14*c*	.14*ww*	7.90*ll*
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	.19	.....	9.25
New York	2.63‡	2.38‡	....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	....	....	.14	.14*wcc*	7.50*k*
Philadelphia	2.33	2.08	1.88	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	.155	.155*w*	8.20
Pittsburgh	2.44	2.19	1.99	1.40‡	1.40‡	1.70‡	2.25‡	2.25‡	1.50	1.50	.17	.17*z*	8.25
St. Louis	2.80	2.52	....	1.75‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*g*	.75*g*	.125	.105*w*	8.00
San Francisco	....*u*	2.22	1.92	1.36	1.36	1.36	1.46	1.46	....	....	....	.20*aa*	7.55
Seattle	2.95*o*	2.75*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	....	....	.16	.....	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Plus municipal tax. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* Up to 200 cu.yd. *m* 50c. off for cash *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* Price withdrawn. *v* 20c. per bbl. discount; 20c. allowed for returnable cloth bag. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* Also 8 x 18 x 18 in.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn.	$1.80	$1.75
Dallas, Tex. (Inc. 9c. tax)	1.84	1.79	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.80	1.75
Hannibal, Mo.	1.70	1.65	Norfolk, Va.	1.75	1.70	Universal, Pa.	1.65	1.60
Hudson, N. Y.	1.75	1.70	Northampton, Pa.	1.55	1.50	Waco, Tex. (Plus 9c. tax in Tex.)	1.75	1.70
Independence, Kans.	1.70	1.65	North Birmingham, Ala.	1.70	1.65	Montreal (8% sales tax incl.)	1.68	1.67
						Discount 10c per bbl. 20 days		

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICK AND BLOCK Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	PAVING ASPHALT Per ton, less than 80 penetration Tank car	Drums	ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration Tank car	Drums	CUTBACK ASPHALT Per ton Tank car	Drums	ROAD OIL Per gal. Tank car	ASPHALT EMULSION (Quick-breaking) Per gal. Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.40*e*	$24.62*e*	$0.0787*e*	$0.1309*e*	$0.0876*he*	$0.1348*h*	$0.0676*e*	$0.0826	$0.1384
Baltimore	150.00‡	48.00	80.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.065*r*	.07*r*	.14*r*
Birmingham	.....	32.00*y*	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.09	.....†
Boston	80.00	55.00	3.75	14.20	20.00	.06	.09	.065*h*	.115*h*	.065	.09‡	.12‡
Chicago	150.00	55.00	1.80/2.00*d*	14.00	22.50	13.00*g*	21.50*g*	.0575*h*	.15*h*	.05*n*	.09/.10*n*	.13/.15*n*
Cincinnati	118.00	37.50	.....	16.40	.....	.085	.....	12.25	.....	.07	.085	.....
Cleveland	118.00	37.50	2.25	19.00	20.00	.09	.105	.10*h*	.15	.085	.09	.093
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07/.09
Denver	.....	27.50	.....	11.00	.....	10.00	.....	.0475*h*	.....	.....	.....	.....
Detroit	.....	37.50	.....	18.06*f*	25.60*f*	.0743	.128	.0718*h*	.119*h*	.067	.0755	.1149
Kansas City	.....	40.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	.....	9.00*b*	23.00	9.50*bg*	24.00*bg*	9.50*b*	.....	.025	.072	.15
Minneapolis	.....	.....	2.30*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	.....
Montreal	.....	.....	.....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080	.....
New York	.....	70.00	.....	17.40	24.20*p*	14.00	.....	.0725*h*	.1325*hp*	.....	.0725*p*	.1225*p*
Philadelphia	130.00	58.00	4.06	15.00	.....	14.00	.....	.065*h*	.....	.....	14.00*g*	.....
Pittsburgh	135.00	38.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis	.....	37.00	.....	16.00	22.00	15.00*g*	21.00*g*	.0575*h*	.1213*h*	.048	.0525	.1125
San Francisco	.....	70.00	.....	9.50	18.75	9.50*gr*	18.00*gr*	10.00	17.50*r*	9.50*gr*	.0525	.1125
Seattle	.....	60.00*e*	.....	10.90*i*	19.40*i*	.....	20.40*gi*	11.40*i*	.....	10.90*i*	.0525*i*	.0625*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martines. *j* 3x3½x8½ in. *k* Tax included. *m* Per thousand. † Available on priority only and quoted specially. *p* No steel drum shipments except to armed forces. *r* February 1943 prices, none later available.

NEAR THE END OF A SHIFT—
A DRILLER OUT OF FORGED STEEL

WILL HE DO THIS

OR USE THIS

THE NEED FOR THIS DECISION NEED NOT ARISE WITH TIMKEN BITS.

Drillmen being human have the same weaknesses of all human beings. A driller using forged steels packs in no more than the number of steels he thinks he will need to complete a cut. But encountering tough drilling or steel becomes broken or plugged he finds he must stop drilling to search for more steels and carry them to the working face. Nearing the end of his shift, which after all is when shortages occur, his fatigue causes him to become "more human". He may elect to complete the day running dull drills, eventually finishing the round - - - at an enormous loss of efficiency. Even so there's some justification for his decision. If he must search for steel and pack it to his drill he realizes he will have little time left to sink holes before his shift goes off duty.

Timken Bits prevent these situations from arising. Carrying a few more Timken Bits than the maximum number needed imposes no burden - - - and every driller realizes it's to his advantage to do just that.

This is but one advantage of Timken Bits. We will demonstrate dozens of others. Write for complete details. The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

ROCK BITS

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¾-in billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	TRACK SUPPLIES: Angle Bars	Std. Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	4.75
Chicago	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15	.....
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....	.....
Detroit	.....	2.27‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.80*a*	.....	.....	2.95*a*	.....	.....	.....	.....	.....	2.30	.....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c.l.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS*, Per 100 lb., ¾ in., base price: 15 tons or over *b* New billet	Rail steel	Add $/cwt. for Switch	Del.	EXPANDED METAL LATH, Per 100 sq. yd., carload lots: Std. diamond mesh, 3.4 lb	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING, Per 100 sq.yd., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd.	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.39	$2.39	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
Baltimore	3.70	2.90	2.75	.....	.10	22.50	24.50	1.70	1.27	.1611	3.00
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.00	1.80	1.34	.1701	.....
Boston	3.85	3.51	3.36	$20 C.L.	.10	18.50	29.50	1.76	1.31	.1656	2.70
Chicago	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.40
Cincinnati	3.68	2.53*cd*	2.53*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	.....
Cleveland	2.10*a*	2.15	2.15	.02½	.10	19.50	21.50	1.66	1.25	.1566	.....
Dallas	4.25	3.17	3.17	.....	....	25.00	27.50	1.93	1.42	.1827	.....
Denver	4.35	3.95	3.85	.....	....	26.50	28.50	1.97	1.45	.186	.....
Detroit	3.65‡	2.52‡	2.52‡	.....	.10	25.50	29.50	1.68	1.26	.1584	2.66
Kansas City	4.00	2.61*cd*	2.61*cd*	.0	.05	24.50	26.50	1.78	1.33	.1683	2.89
Los Angeles	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
Minneapolis	3.81‡	2.75	2.75	.0	.10	25.00	27.00	1.80	1.34	.1701	2.75*d*
Montreal	4.00*i*	2.90*a*	2.80*i*	.....	....	26.00*hij*	33.00*hij*	2.56*i*	3.14*i*	.268*i*	.....
New Orleans	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1715	2.875
New York	3.75	2.76*c*	2.76*c*	.....	.15	17.50	19.50	1.76	1.32	.1665	2.74
Philadelphia	3.66	3.82	.....	.....	....	19.50	21.50	1.71	1.28	.1611	2.72
Pittsburgh	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.40
St. Louis	3.69	2.7575	2.7575	.0	.05	28.00	34.00	1.69	1.27	.1602	2.70
San Francisco	4.35	2.825	.....	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.85
Seattle	2.75*e*	2.80*e*	.....	.....	....	34.50	38.50	1.93	1.42	.1827	2.95*d*

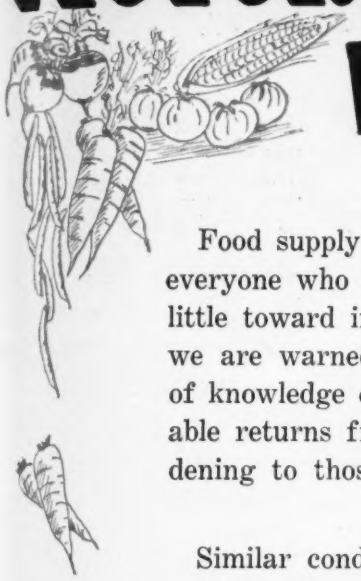
‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* August 1942 price; not on market.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE: Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE Full standard weight, *k*: 1 to 3 in., Black %	Galv. %	Butt Weld 3½ to 6 in.; Black %	Galv. %	Lap Weld
Atlanta	$49.66	$0.265	$0.468*bc*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	51.2	
Baltimore	53.00	.35	.60	2.65	7.25	160.00	200.00	.50	1.75	65.5	57.5	63.0	54.5	
Birmingham	45.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	51.2	
Boston	55.40	.26	.463	2.07	5.85	140.00	.....	.60	.....	.....	.....	.....	.....	
Chicago	54.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53.0	
Cincinnati	53.27	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	57.1	43.4	54.0	39.6	
Cleveland	54.75	.196	.378	1.62	4.715	81.00	125.00	.36	1.60	68.5	57.5	66.0	54.5	
Dallas	56.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3	
Denver	61.56	.29†	.52†	2.16†	3.00*n*	130.00	240.00	1.00	2.22	58.4	50.4	55.7	47.2	
Detroit	54.75	.252	.486	2.09	7.16	78.00	127.00	.36	1.60	57.7	44.0	54.8	40.6	
Kansas City	55.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	35.9	46.4	46.6	59.9	
Los Angeles	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	61.1	50.1	58.6	47.1	
Minneapolis	59.00	.275†	.495†	1.98†	5.37†	.....	.....	.90	2.10	64.2	53.2	60.7	49.2	
Montreal	60.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.48*m*†	1.92*m*†	.....	.....	.....	.....	
New Orleans	51.78	.26	.48	1.69	.....	150.00	220.00	.45	1.65	62.4	54.4	58.8	50.3	
New York	52.40	.322	.621	2.43	6.15	.....	.....	.60	1.40	64.9	53.9	62.4	50.9	
Philadelphia	51.00	.28	.54	2.30	6.75	150.00	225.00	.45	1.75	56.6	42.8	53.6	39.1	
Pittsburgh	56.00	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5*i*	
St. Louis	52.84	.28	.504	2.016	4.50	85.00	220.00	1.10*j*	2.10*i*	56.4	42.6	52.5	38.4	
San Francisco	68.40	.3625*d*	.6525*d*	2.61	6.52	115.50	192.50	.58	2.34	45.0	31.0	41.0	26.0	
Seattle	70.20	.375	.675	2.70	6.75	84.00	187.50	.51*f*	1.44*f*	.....	.....	.....	.....	

‡ Delivered. †F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.; ¼ in., 8½c.; ⅜ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. 3 percent tax on transporation costs not included. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Tax included. *n* 27-in. pipe. *o* Less 50%. *p* Less 53%.

VICTORY GARDENS AND VICTORY CABLES



Food supply and distribution have become enough of a problem so that everyone who can do so is asked to plant a "Victory Garden" and do a little toward increasing our available supply of food. At the same time, we are warned against wasteful use of seed and fertilizer due to lack of knowledge or skill. In other words, if we are not likely to get reasonable returns from the seed, fertilizer and labor, it is better to leave gardening to those who may get better results.

Similar conditions exist in the wire and cable industry. Cable engineering and manufacturing is a task for those with manufacturing skill and technical background. There is need for more and better insulated wires and cables for electrical transmission but the materials from which to make them are limited in quantity and can best be used by those who have the "know how" based on long experience.

Here at Simplex we have devoted nearly sixty years exclusively to the study and manufacture of insulated wires and cables. We have one objective and only one—to make better cables and do it more efficiently. Through study and experience we have developed skill which enables us to make the most of the limited materials now obtainable. Simplex wires and cables—now available only for high priority war work—meet all conservation regulations yet still retain those qualities that assure satisfactory service. Improvements that cannot be disclosed now will make Simplex wires and cables better than ever after the war.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Fox. (Prices in Bold Face) — All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 S2S	6x12 S2S	12x12 S2S	2x12 S2S	12x12 S2S	¼"	¾"
Atlanta	$33.00	$33.00	$28.00	$27.00	$27.00	$30.50	$46.00	.....	.....	$54.00	$62.00	$17.90	$21.85
Baltimore	40.00	43.00	40.00	40.00	41.00	45.00	60.00	.....	.....	110.00	115.00	18.25	22.25
	48.00	*49.00*	*52.00*	*53.00*	*52.00*	*52.00*	*63.00*	*$70.00*	*$70.00*	.....	.....	.....	.....
Birmingham	34.50	36.50	32.00	32.00	34.00	34.00	53.00	53.00	56.00	.....	.....	17.35	21.15
[1]	37.50	37.50	37.00	37.00	37.00	43.00	65.00	.....	.....	67.50	70.00	.....	.....
Boston [‡*]	.....	.....	50.00[2]	55.00[2]	.....	.....	.....	.....	.....	.....	.....	18.25	22.25
[‡*]	*45.00*	*45.00*	*50.00*	*55.00*	*60.00*	*70.00*	*75.00*	*80.00*	*80.00*	.....	.....	.....	.....
Chicago	43.00	44.00	40.00	39.00	40.00	41.50	60.00	.....	.....	80.00	95.00	14.60	17.80
	50.00	*50.00*	*47.50*	*47.00*	*47.00*	*48.00*	*57.00*	*56.50*	*58.00*	.....	.....	.....	.....
Cincinnati	41.00	42.50	39.00	40.50	42.00	43.00	53.00	.....	.....	65.00	68.00	17.35	21.15
	.....	.....	.....	.....	.....	.....	*55.50*	*55.50*	*55.50*	.....	.....	.....	.....
Cleveland	42.50	42.50	52.50	51.00	51.00	54.00	78.00	70.00	70.00	.....	.....	17.75	21.60
Dallas [e]	41.50	42.50	38.50	37.50	37.50	38.50	53.50	53.00	53.00	78.00	83.00	14.60	17.80
Denver [‡]	54.00[4]	52.00[4]	55.00[4]	55.00[4]	55.00[4]	56.00[4]	59.00[4]	*73.00*	*79.00*	.....	.....	10.45	12.70
Detroit	44.00	44.00	44.00	43.50	44.00	46.00	60.00	.....	.....	53.00	63.00	17.35	21.15
	.....	.....	.....	.....	.....	*51.00*	*55.00*	*60.00*	*60.00*	.....	.....	.....	.....
Kansas City	50.00	55.00	52.00	52.00	52.00	55.00	75.00	.....	.....	75.00	85.00	12.60	15.40
	50.00	*55.00*	*55.00*	*55.00*	*55.00*	*56.00*	*75.00*	*80.00*	*80.00*	.....	.....	.....	.....
Los Angeles [a]	*55.00*	*55.00*	*53.00*	*53.00*	*51.00*	*51.00*	*57.00*	*65.00*	*66.00*	157.50	167.50	9.90[h]	12.05[h]
Minneapolis [‡b]	49.00[8]	49.00[8]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60	15.40
[‡]	*53.00*	*53.00*	*53.00*	*52.00*	*52.00*	*53.00*	*59.00*	*61.00*	*61.00*	.....	.....	.....	.....
Montreal [†7]	*52.00*	*55.00*	*48.00*	*52.00*	*54.00*	*60.00*	.....	.....	.....	200.00	200.00	.....	.....
	42.50	*42.50*	*45.25*	*45.25*	*45.25*	*46.75*	*50.00*	*50.00*	*50.00*	.....	.....	.....	.....
New Orleans	31.50	31.50	33.75	31.75	34.00	35.00	48.00	.....	.....	69.00	69.00	14.60	17.80
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	.....	.....
New York [‡j]	60.50	61.50	56.25	55.25	56.25	59.50	67.50	.....	.....	120.00*f*	125.00*f*	18.35	22.25
[‡]	.....	.....	*65.00i*	*65.00i*	*65.00i*	*65.00i*	[Range from $75 to $95]			.....	.....	.....	.....
Philadelphia	53.00	53.00	52.00	51.00	51.00	54.00	74.00	.....	.....	116.00	112.00	18.25	22.25
	[*$60.00 to $75.00*]		*65.00*	*66.00*	*66.00*	*66.00*	*67.50*	*$75 to $95*	*$75 to $95*	.....	.....	.....	.....
Pittsburgh	50.50	53.20	62.75	55.00	60.85	62.50	76.25	.....	.....	.....	.....	18.10	22.05
	69.20	*68.10*	*66.10*	*65.30*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	.....	.....	.....	.....
St. Louis [‡c]	52.00	52.00	49.00	48.00	49.00	52.00	67.00	*74.00*	*74.00*	85.00	84.00	14.60	17.80
San Francisco [d]	*35.50*	*35.50*	*37.00*	*37.00*	*36.50*	*36.50*	*40.50*	*49.50*	*49.50*	.....	.....	7.30*g*	8.90*g*
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [6] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¾", $95.15; on ¾", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $69. *j* Average price

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 — Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*
	A quality	B quality	
Atlanta	75%	75%	$0.15
Baltimore	78%	79%	.15
Birmingham	76%	76%	.105
Boston	77%	78%	.15
Chicago	77%	77%	.15
Cincinnati	77–10%	77–10%	.15
Cleveland	77–10%	77–10%	.19
Dallas	76%	76%	.1625
Denver	76%	76%	.155*e*
Detroit	77%	77%	.1575
Kansas City	76–10%	76–10%	.155
Los Angeles	86%*d*	88%*d*	.1575
Minneapolis	77%	77%	.155
Montreal	40–5%‡	47%‡	.1675†
New Orleans	70%	75%	.16
New York	81%	82%	.22*f*
Philadelphia	78%	79%	.15
Pittsburgh	79%	79%	.1225
St. Louis	77–10%	77–10%	.155
San Francisco	66–15%	73–15%	.155
Seattle	75%	75%	.1575†

Price of 60% Ammonia Gelatin in $0.01 per lb. higher than 40%

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers' list Sept. 15, 1928. ‡ Sales tax included.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered from barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf — Barge	Short Leaf — Rail
12 in. at butt	6 in.	30 to 50 ft	...	$0.28
12 in.— 2 ft. from butt	6 in.	50 to 59 ft	...	.30
12 in.— 2 ft. from butt	6 in	60 to 69 ft	...	.35
14 in.— 2 ft. from butt	6 in.	50 to 69 ft	...	.35
14 in.— 2 ft. from butt	6 in.	70 to 79 ft	...	.39
14 in.— 2 ft. from butt	5 in.	80 to 85 ft.	...	.50
14 in.— 2 ft. from butt	5 in.	85 to 89 ft.	...	.55

RAILWAY TIES

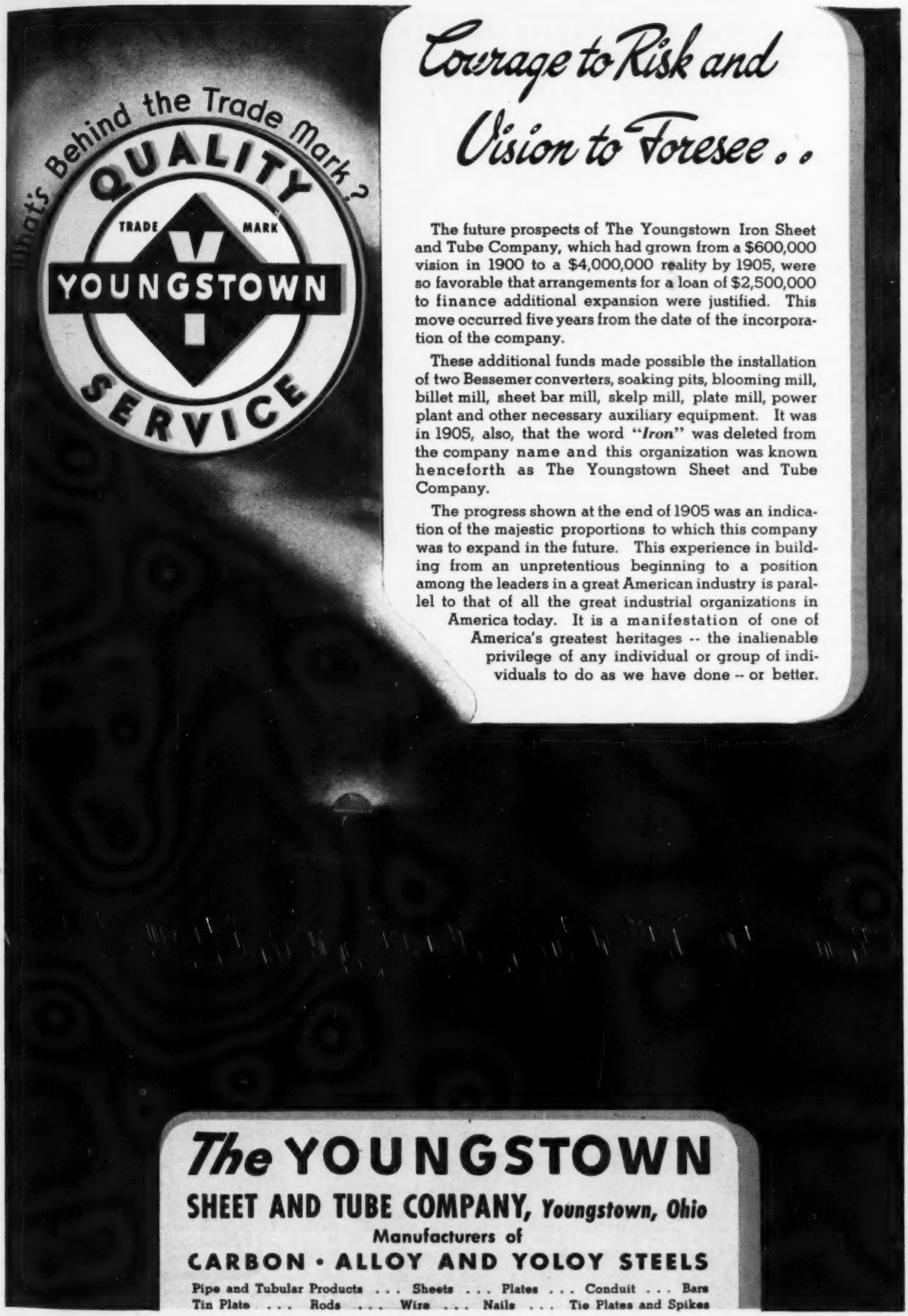
Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	....	$2.00	....
	Pine	2.00	$3.00*a*	3.00	$3.50*a*
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	White Oak	1.00	1.60*a*	1.30	2.25*a*
	Southern Pine	....	....	....	....
Chicago	Red Oak	....	2.19*a*	....	2.87/3.00*a*
	Southern Pine	....	....	....	....
Los Angeles	Douglas Fir	1.10	1.75*a*	1.60	2.50*a*
Philadelphia	Red Oak	....	2.10*ag*	....	3.25*ag*
St. Louis	White Oak	1.65*	....	1.90*	....
	Red Oak	1.55*	2.15*a**	1.90*	2.70*a**
	Sap Pine or Cypress	1.35*	....	1.70*	....
San Francisco	Douglas Fir	1.15*bef*	....	....	3.00*af*
Montreal	Birch or Maple	.85	.95	....†	....†

Tr.— Treated; Untr.— Untreated. *a* Creosoted *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. * September 1942 price, OPA ceilings effective. *g* January price, none later available.

CHEMICALS

Water, sewage treatment road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb.	$2.50– 3.10
Chlorine cylinders, liquid, per lb. delivered	.0325
Calcium chloride, 77–80%, flaked, in 100-lb. paper bags, delivered, per ton	18.50–35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00–25.00
Sulphate of copper, in bbl., per 100-lb.	5.00– 5.15



Courage to Risk and Vision to Foresee . .

The future prospects of The Youngstown Iron Sheet and Tube Company, which had grown from a $600,000 vision in 1900 to a $4,000,000 reality by 1905, were so favorable that arrangements for a loan of $2,500,000 to finance additional expansion were justified. This move occurred five years from the date of the incorporation of the company.

These additional funds made possible the installation of two Bessemer converters, soaking pits, blooming mill, billet mill, sheet bar mill, skelp mill, plate mill, power plant and other necessary auxiliary equipment. It was in 1905, also, that the word "*Iron*" was deleted from the company name and this organization was known henceforth as The Youngstown Sheet and Tube Company.

The progress shown at the end of 1905 was an indication of the majestic proportions to which this company was to expand in the future. This experience in building from an unpretentious beginning to a position among the leaders in a great American industry is parallel to that of all the great industrial organizations in America today. It is a manifestation of one of America's greatest heritages -- the inalienable privilege of any individual or group of individuals to do as we have done -- or better.

The YOUNGSTOWN
SHEET AND TUBE COMPANY, Youngstown, Ohio
Manufacturers of
CARBON • ALLOY AND YOLOY STEELS
Pipe and Tubular Products . . . Sheets . . . Plates . . . Conduit . . . Bars
Tin Plate . . . Rods . . . Wire . . . Nails . . . Tie Plates and Spikes

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized, or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$13.50	$18.04	$26.54	$15.04	$15.04
Baltimore	84.00	90.00	170.00	200.00	260.00	320.00	15.00k	19.00k	18.00	13.00	2.50m
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	2.25s
Boston	89.35a	93.30a	178.70a	202.50	271.80	308.20	16.50i	19.50i	17.50†	12.50†	14.92†
Chicago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00	12.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	17.50	17.50	15.50	13.00	.....
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75j	13.25j	3.00jm
Dallas	62.50	67.50	135.00	162.00	212.50	263.00	13.50i	15.00i	19.00	15.00	.95n
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	17.00	25.00j	17.00j	20.00j
Detroit	86.05	91.80	172.10	213.00	268.00	330.00e	17.50	18.00	18.00	16.00	16.00
Kansas City	67.00	69.00	89.00e	128.00	163.00	189.00	15.50	16.50	19.32	13.00	10.92
Los Angeles	73.50†r	89.50†r	128.00e†r	210.00†r	368.00†r	460.00†r	13.50	15.00	16.50	17.50	17.50
Minneapolis	81.95b	87.40b	148.70b	.....	179.30b	249.35b	13.60	15.60g	21.00	16.00	19.00
Montreal	99.10a	105.65a	154.75a	104.65at	154.75au	155.25	24.16†u	27.25†u	24.60u	18.00u	.....
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	78.40	83.60	115.00e	193.30h	238.80h	295.60h	15.00s	.....	20.00	14.00	17.00
Philadelphia	85.30	91.00	190.50	186.30	235.00	261.10	17.00	20.00	19.00	13.00	15.00
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2.55m
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	2.50m
San Francisco	84.00	94.50	225.00	.....	.....	.....	17.50	22.00	20.00	20.00	16.40
Seattle	115.00	125.00	230.00	.....	.....	.....	20.00f	21.00f	20.00s	20.00s	20.00s

† F.o.b. a Smooth. b Carload lots delivered to job. c 6x12x12 in. d Not load bearing. e 48 lb. tile. f Less $1.00, ½ cash 15 days, balance 30 days. g Selected common. h F.o.b. Perth Amboy, N. J. i F.o.b. Warehouse only. j LCL. k $1.00 discount if paid in 10 days. l Lump. m Per bbl., 180 lb. n Per sack 100 lb. o Per bbl., 200 lb. p 280 lb. bag. r 5% discount 10 days. s 2% discount for cash. t 5½x8x12. u 8% sales tax included. v April price.

PAINT, ROOFING—F.O.B. CARLOAD LOTS

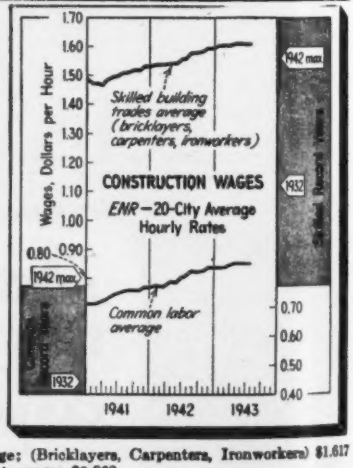
	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry a	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite b	Aluminum b	Ferric Oxide d	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
Birmingham	10.25	14.125	2.35	3.50r	1.98r	2.04	1.97	1.97	.32	28.35
Boston	10.00	13.75	1.60	....	2.40	2.12‡	1.72h‡	1.72h‡	.50‡	20.00‡
Chicago	10.00	13.75	....	....	....	1.75h/f	1.74h/f	1.82h/f	.33f	23.00f
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39h	2.39h	.36	21.00
Cleveland	10.00	13.75	2.10	2.90	1.95	1.93	1.83h	1.83h	.35	29.00
Dallas	10.00	14.50	1.88	2.11n	.05l	1.75h	1.66h	1.66h	.35	39.00
Denver	10.50	14.25	1.65	....	.27l	2.45	3.15	3.15	.35	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.10	2.06	2.06	.35	23.00
Kansas City	10.00	13.875	2.39g	2.55gr	2.16g	2.10	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.75i	1.66h/i	1.66h/i	.32	23.00
Montreal	9.25	6.25	2.50p	4.00p	3.16p	2.67	2.07	2.07	.94	1.85k
New York	10.00	13.75	2.03	....r	1.64	1.66	1.58h	1.58h	.26	25.00
Philadelphia	10.00	13.75	1.60/1.80	2.20r	1.55	1.75	1.66	1.66	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94h	1.94h	.34	26.00
St. Louis	10.00	13.75	2.28s	2.89s	1.96s	1.66	1.66	1.66	.35	24.00
San Francisco	10.25	14.00	1.80	2.75n	1.35/2.35	1.71	2.40	2.40	.33	19.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16h	....	.35	26.50j

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. a Red lead prices change frequently due to pig lead price charges. b U. S. War Dept. Spec 3-49A. c ASTM Spec. D266-31. d 80% minimum ferric oxide. e Subject to 25% discount. f Distributors' price to contractors. g 5 gal. can. h Per roll, 65 lb. i Minneapolis and vicinity. j Asphalt pitch. k Per 100 lb. l Per lb. m Per bbl. n May, 1941 price, no later quotation available. p Plus 8% sales tax. r Not available, except on priority rating; then quoted specially. s December price.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor—Building	Common Labor—Heavy Const.
Atlanta	$1.50	$1.25	$1.50	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.375	1.80	1.625/1.80	1.50	.75	.75
Birmingham	1.75	1.125/1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.625	1.50	1.65	1.875	1.667	.80/1.00	.80/1.00
Chicago	1.75	1.70	1.76	1.75	1.825	1.10	1.10
Cincinnati	1.75	1.50	1.675	1.45/1.60	1.625	.85	.85
Cleveland	1.75	1.55	1.75	1.75	1.75	1.00	1.00
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75/1.25
Denver	1.65b	1.50b	1.625b	1.43b	1.51b	.80b	.80b
Detroit	1.675	1.50	1.75	1.625/1.75	1.675	.90	.90
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.50	1.375	1.50	1.40	1.50e	.925	.925
New Orleans	1.50	1.25	1.50	1.50	1.375	.65	.75
New York	2.00b	1.85b	2.00	2.00b	2.00b	1.031	.95
Philadelphia	1.90	1.50	1.90	2.00	2.00	.825	.825
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	.90	.80
St. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
San Francisco	1.75	1.50	1.75	1.50/1.75	1.75	.95	.95
Seattle	1.78	1.48	1.68	2.00	1.78	1.08	1.10
Montreal	.965	.855	.90	.80	.945	.505	.505

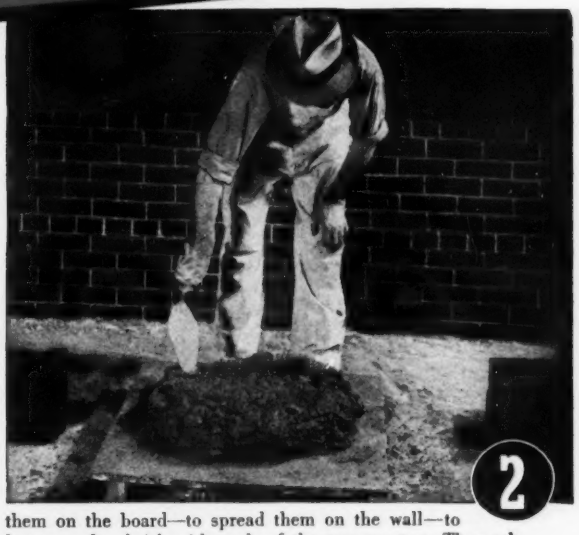
b 7 hr. day e 30 hr. wk



ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.617
ENR Common Average: $0.863

MAKE THIS TEST — Prove BRIXMENT is BEST!

Mix a batch of 1-3 Brixment mortar (above) and a batch of 50-50 cement-lime mortar made with the same proportion of sand (right). Get any competent bricklayer to test them on the board—to spread them on the wall—to lay up a few brick with each of the two mortars. Then ask him *which* has the best workability.



BRIXMENT *Assures More Economical Brickwork*

Aside from the cost of the brick itself, the most expensive item in masonry construction is the bricklayer's time.

Therefore the most economical mortar you can buy is the one that enables the bricklayer to lay the most brick per day. You cannot afford to give your bricklayer any mortar which causes unnecessary work, such as constant retempering, stooping to the board to replace mortar that failed to stick when he threw up the head-joint, etc.

To secure economical brickwork, the mortar must have excellent workability.

The plasticity of Brixment mortar is *ideal.* It approaches that of straight lime putty. It enables the bricklayer to do faster, neater brickwork, with the brick well bedded and the joints well filled.

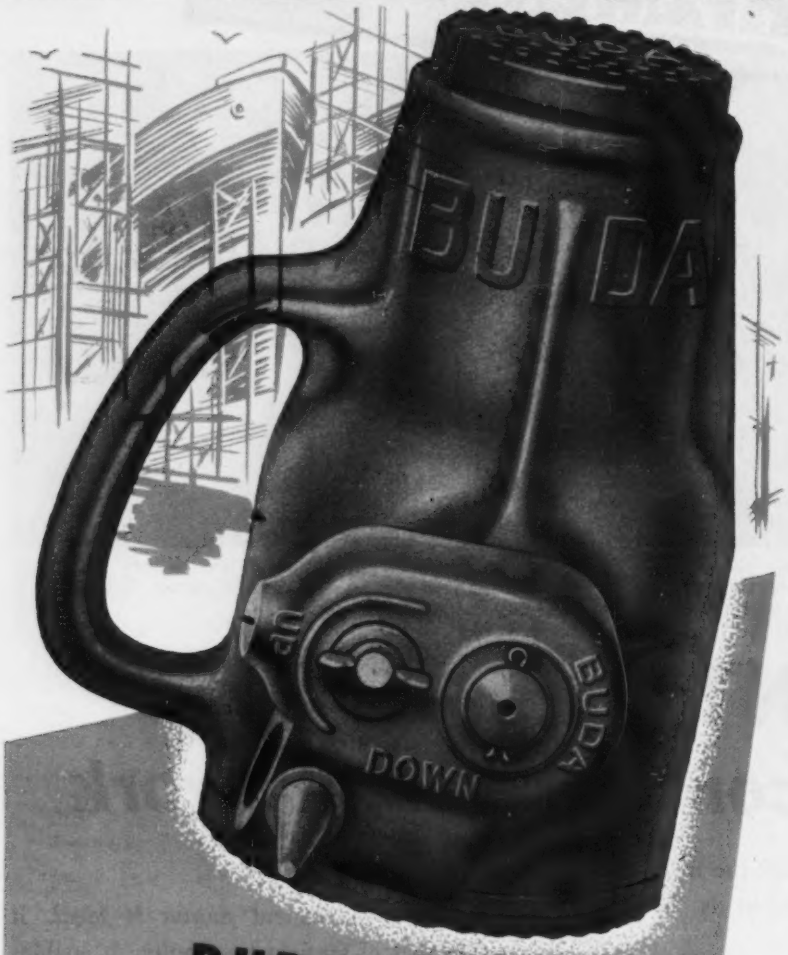
This is the principal reason why Brixment reduces the cost of brickwork. But in addition, less labor and supervision are required in mixing. No soaking or slaking. No mortar is wasted. And Brixment mortar makes a neater job that costs less to clean down.

BRIXMENT

For Mortar and Stucco

Louisville Cement Company, Incorporated, Louisville, Kentucky. Cement Manufacturers for Over a Century.

BUDA



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shipbuilding
WRITE NOW FOR THE BUDA JACK POCKET MANUAL

the BUDA company
HARVEY (CHICAGO SUBURB) ILLINOIS

BUDA
ESTABLISHED
1881

Industrial Flooring

This new product, it is asserted, resists the penetration of acid, water, oil, and grease to an unusual degree. It facilitates cleaning and sanitation as it affords no place for germs and waste matter to accumulate. In addition to its imperviousness, this floor is said to be durable, smooth, and dustless. It will withstand heavy traffic, such as the rolling of drums or barrels and the grinding steel wheels of heavily laden trucks. This product has been developed to meet conditions prevalent in machine shops, boiler rooms, dairies, canneries, sugar refineries, distilleries, dye-houses, meat and food packing plants and similar places.—*Flexrock Co., 2300 Manning St., Philadelphia 3, Pa.*

Paint Stick Marker

A new paint stick marker for use on all cold surfaces is announced. It makes a wider, more highly legible mark than many other methods according to the manufacturers. It is real paint in stick form and produces permanent, fade-proof, weather-proof markings on metal, lumber, rubber, stone, marble, hard polished plate glass, porcelain, vitrolite, plastics, cellophane and other surfaces. It is fast drying. It is particularly suitable for layout purposes on steel plates, whether bare or coated with zinc chromate or other protective coatings used in pickling. The marks will dry immediately after application so that plates or surfaces may be handled without smearing.—*Markal Co., 60 E. Lake St., Chicago, Ill.*

Asphalt Mixing Plant

Contractors bidding on black-top jobs, where time and speed are important factors, will be interested in this new portable asphalt plant which features easy

portability by truck and swift erection and knock-down. It has a capacity of from 3,000 to 4,000 lb. of hot or cold bituminous mix per batch.

Electric, gasoline or diesel power can be used. On electric drive plants, each unit is powered by an individual electric motor, eliminating countershafts, bearings, chains, and sprockets, permitting simplicity and faster assembly and knock-down. — *Iowa Mfg. Co., Cedar Rapids, Iowa.*

Drop-Bottom Skid Box

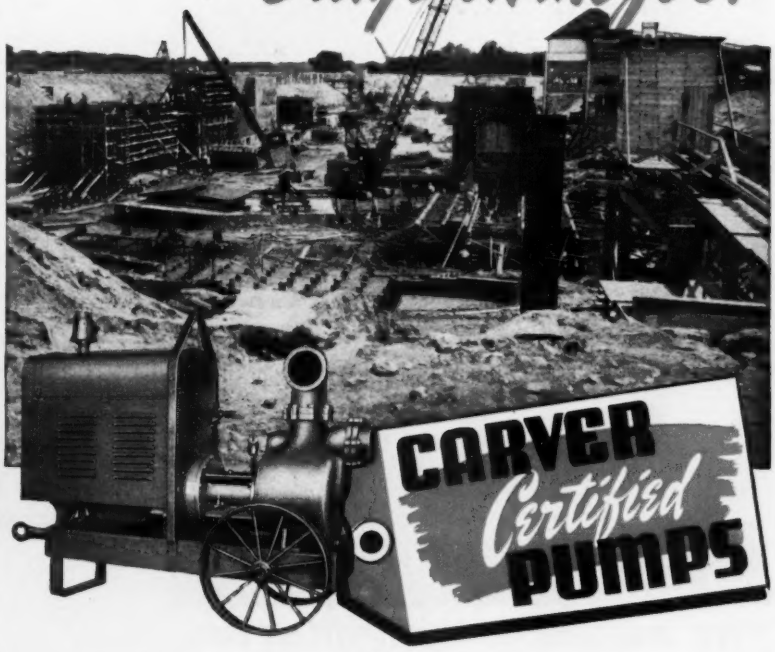
In answer to a demand for a skid box that could be dumped with standard fork or high-lift power trucks, engineers have developed the drop bottom skid box illustrated.

This new unit consists of an all-steel box, attached to a skid platform with a continuous hinge at one end. Welded steel plates are used to hold the skid in position at the end of the forks and prevent it from sliding back as the forks are lowered. Attached to the top rear of the box are latch rings which are hooked over a plate welded to the truck mast when the unit is being used. As the forks are lowered, the skid portion goes down while the box portion goes up, and the contents of the box are dumped in front of the unit. The drop bottom dump skid box may also be used as a standard skid box for unit load transportation, or handled by hand lift trucks for short operational spotting.—*Union Metal Mfg. Co., Canton, Ohio.*

Pressure Pipe

This pipe is made of asbestos and cement and the process of precision fabrication provides it with a high degree of dimensional control, on both inside and outside diameters, according to the manufacturers. The result is exterior and interior walls of extreme smoothness and uniform thickness. It requires no machining either in the factory or in the field. The pipe is said not to be affected by neither tuberculation nor electrolysis and offers permanently high

THE PUMP THAT *Stays on the job!*



ON the really *tough* pumping jobs where dirt, sand and grit take rapid toll of ordinary pumps, rugged CARVER centrifugals are setting records for consistent high performance. Long, trouble-free service is a job-tested *fact* about CARVER pumps that will mean dollars and hours saved on *your* job, for these outstanding centrifugals maintain their lightning-fast prime, their extremely high efficiency, even after thousands of hours of pumping.

For a pump that starts out ahead and *stays* ahead—specify CARVER on your job!

•

Gas engine, electric motor or belt-driven CARVER centrifugals are built in capacities from 5,000 to 125,000 G.P.H.

•

Get the *facts* about these efficient, long-lived pumping units — write NOW for your copy of the CARVER pump catalog.

CARVER PUMP CO., Muscatine, Iowa

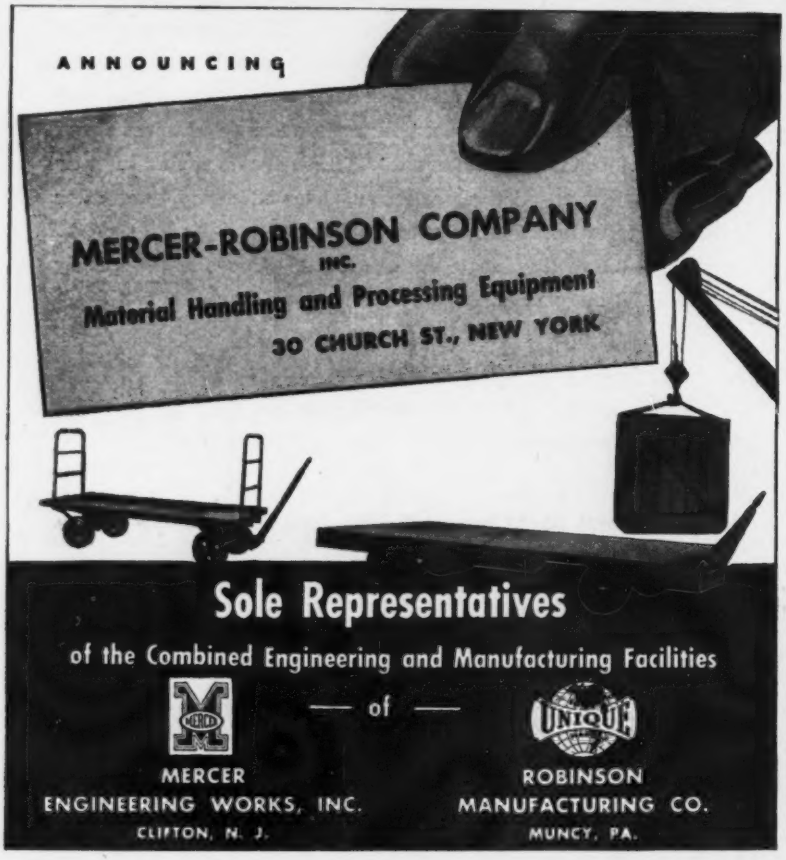
CARVER CENTRIFUGAL *Certified* PUMPS

Stop Production Delays Caused by Hard Water

Serious shutdowns due to hard water problems can be avoided with properly conditioned water. Wherever water is heated, wherever soap or soda is used, wherever there is a boiler, you need conditioned water. Refinite softeners, filters, and other water-conditioning units will give you the conditioned water you need.

THE REFINITE CORPORATION

Write for free catalog 102 Refinite Bldg. Omaha, Nebr.



Sole Representatives

of the Combined Engineering and Manufacturing Facilities

— of —

MERCER ENGINEERING WORKS, INC. CLIFTON, N. J.

ROBINSON MANUFACTURING CO. MUNCY, PA.

carrying capacity with economies in installation and maintenance.—*The Ruberoid Co., 500 Fifth Ave., New York, N. Y.*

Curing Concrete

This is a new chemical reaction method of curing or sealing freshly poured concrete. It eliminates the trouble and the high cost of curing with water and burlap, soil, straw, etc., and puts an end to all the drawbacks of ordinary seals states the manufacturers. The manufacturer claims it is not made from by-products but has been developed to provide by chemical reaction the most perfect concrete seal possible in the simplest, quickest way.—*R. W. Willits Laboratories, 75 E. Wacker Drive, Chicago, Ill.*

Industrial Safety Goggles

A new, highly efficient, all-plastic goggle is authorized by WPB to use high-priority glass for lenses. The lens material is crystal clear, non-distorting, and will not shatter or splinter under impact state the manufacturers. The goggle fits directly over prescription glasses, and the full frame gives added protection against injury from sides, top and bottom. Lenses can be easily removed for cleaning or replacement. The frame is strongly reinforced with a metal clip at the bridge, and is amply ventilated to prevent fogging. It weighs only 1¾ ounces. — *Watchemoket Optical Co., Providence, R. I.*

Plastic Battery Retainer

Announcement of a plastic storage battery retainer manufactured from polystyrene for use in certain types of Exide batteries is made by the manufacturer.

Retainers play an important part in the performance and life of the storage battery. They are a part of the separation or insulation between the positive and negative plates, and act principally to retain the active material in the positive plates. This new retainer is said to have not only technical advantages but

These two kinds of wire rope are made in our factory of the same special analysis high carbon steel, the same carefully controlled heat treatment and continuous wire drawing process. As made by our skilled craftsmen both give you plus value.

Yet there is a difference which means money-in-your-pocket. It is this: In ordinary wire rope of any make, the wires are "laid" into position without first being relieved of stresses set up through changing wires from straight to helical or spiraling shapes. Under these unresolved stresses, the wires have a strong tendency to fight each other and will fly apart when the seizing wire is removed. This wasted effort cuts down the resistance to bending fatigue of the rope as a whole.

In *Union-formed* wire rope, the method of helical or spiral shaping the wires in it before they become component parts, entirely frees the rope of shaping stresses. Thus preformed, parts lay in their positions in such perfect repose that they will not fly apart—in fact, often must be pried from position. *Union-formed* wire rope, therefore, utilizes its full stamina for maximum resistance to bending fatigue. That is why *Union-formed* wire rope bends more easily. Every wire and every strand pulls together to wear longer.

This is only one of 10 time-saving, money-in-your-pocket advantages of *Union-formed* wire rope. To the limit permitted under conditions of war, Union is striving to satisfy urgent needs outside of war production.

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2134 Manchester Ave., KANSAS CITY, MO.
Tulsa • Houston • Chicago • Salt Lake City • New Orleans
Monahans, Texas • Portland • Ashland, Ky. • Atlanta

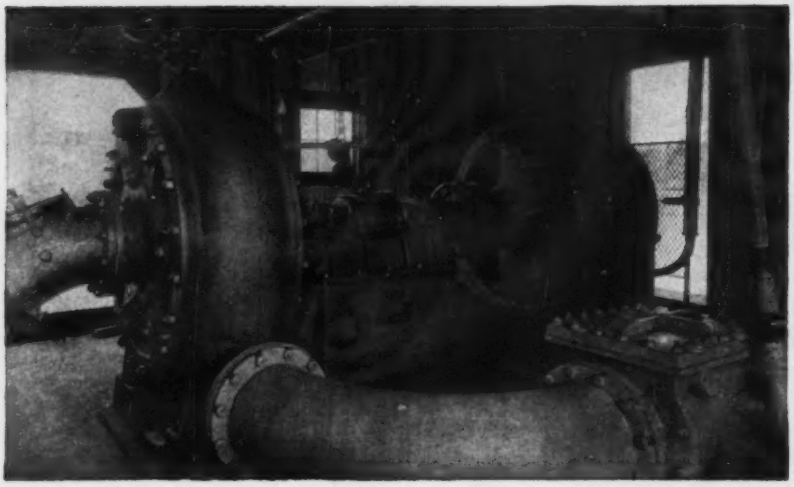
IF YOU ARE NOT ON OUR MAILING LIST send for these bulletins: "ROPE DOPE," "Socketing Wire Rope," "Splicing Wire Rope," "Correct Handling of Wire Rope," and "Wire Rope Lubrication." Engineering information supplied without obligation. G-43

union *Wire Rope*
"THE ULTIMATE IN LOW COST WIRE ROPE"

Each ★ Represents Another 6 Months of Star Performance

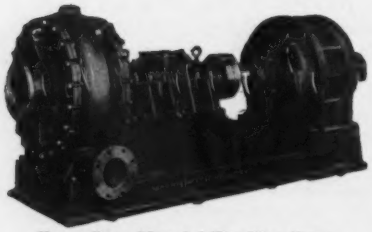
WAR PRODUCTION EXCELLENCE WILL BRING POST WAR PLUS VALUES

WHEN YOU NEED PREFORMED WIRE ROPE SPECIFY **union-formed**

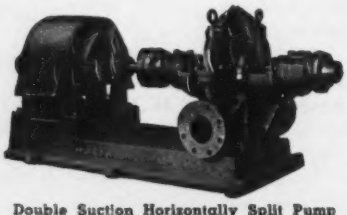


"It may be of interest to you..."

So wrote *an old-time customer when telling us that his 40-year old Morris Centrifugal Pump is still in daily service and too good to be replaced. It may interest YOU to know this too, for it indicates the stamina that has always been built into every Morris Pump. Whatever may be your pumping requirements, be sure to investigate Morris Pumps—they will give you high efficiencies and long troublefree service. Bulletins on request.*



Heavy-Duty Material Handling Pump

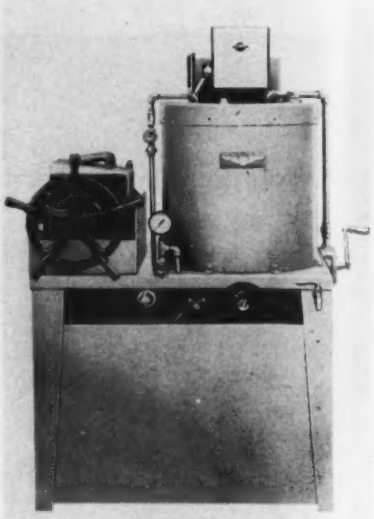


Double Suction Horizontally Split Pump for Clear Liquids

MORRIS MACHINE WORKS — MORRIS — ESTABLISHED 1864 — BALDWINSVILLE NEW YORK

CENTRIFUGAL PUMPS

also to be more permanent than other types of retainers. In addition, as it is now being made, it uses less critical material.—*Electric Storage Battery Co., Philadelphia, Pa.*



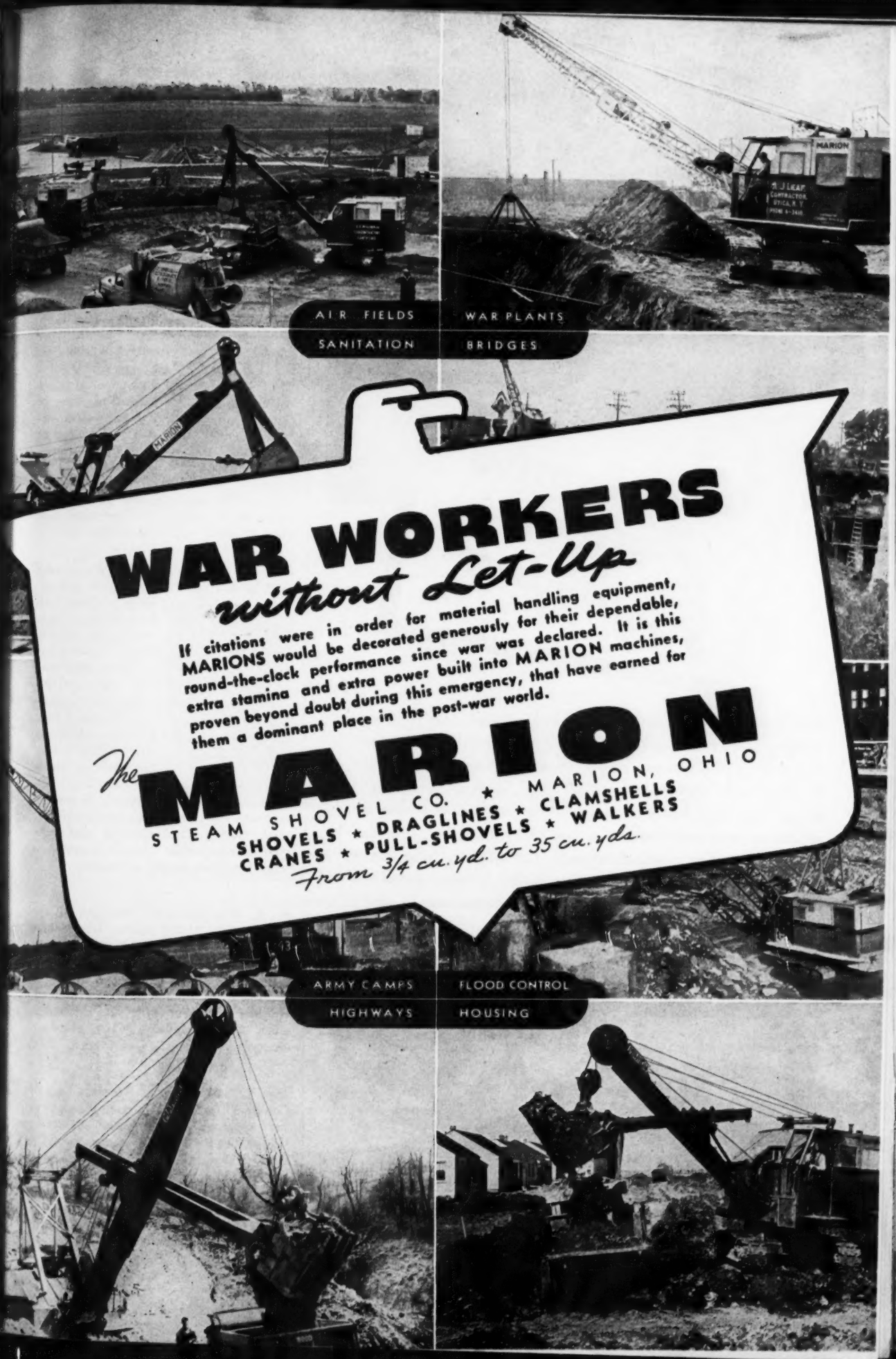
Oil Reclaimer

A new small capacity lubricating oil reclaimer, designed for small plants and organizations having their own fleet of trucks and motor cars, is now being manufactured. In addition to reclaiming lubricating oils of the motor fleet, this reclaimer can usually handle a limited quantity of waste lubricating oils drained from equipment.

The machine has a two-stage filter press, is semi-automatic, operating under thermostatic control, and utilizes common refinery earths available on the open market. For handling larger quantities of lubricating or hydraulic oils, this company builds these units in seven other sizes; all models are designed to restore used oils to substantially the same values of fire, flash, viscosity, color, neutralization number, and precipitation number as the new parent oil.—*Youngstown Miller Co., Sandusky, Ohio.*

Pulley Lagging

Widely extended uses are reported for a new lagging which, it is claimed, conserves both power and belts. The pile-face surface, designed to promote better traction and longer belt life, is woven as an integral part of the lagging body, yet imparts no tension strain to the base, which maintains a snug fit on the pulley. This solid woven base prevents bolts or screws from pulling out. The manufacturers have issued a new circular which fully describes this type of pulley lagging and the most efficient methods of applying it to the pulleys.—*Victor Balata & Textile Belting Co., Easton, Pa.*


AIR FIELDS
WAR PLANTS
SANITATION
BRIDGES
MARION
WAR WORKERS
without Let-Up
If citations were in order for material handling equipment, MARIONS would be decorated generously for their dependable, round-the-clock performance since war was declared. It is this extra stamina and extra power built into MARION machines, proven beyond doubt during this emergency, that have earned for them a dominant place in the post-war world.
The MARION
STEAM SHOVEL CO. ★ MARION, OHIO
SHOVELS ★ DRAGLINES ★ CLAMSHELLS
CRANES ★ PULL-SHOVELS ★ WALKERS
From 3/4 cu. yd. to 35 cu. yds.
ARMY CAMPS
FLOOD CONTROL
HIGHWAYS
HOUSING

Conservative Ratings ...a safety factor

The Twin Disc Clutches or Power Take-offs on your road machinery were conservatively rated AT THE FACTORY, based on a quarter of a century's experience in building friction clutches for all types of heavy-duty industrial use. Thus an ample safety factor is provided which assures full wear-life, with less need for service or parts replacement . . . that's why Twin Disc Clutches can be counted on to stand up under the shocks of heavy-duty work and long hours of continuous operation . . . and it's also one of the reasons why so many nationally-known builders of power shovels, graders, compressors, road rollers, pavers and various types of heavy-duty road machinery offer Twin Disc Clutches as standard equipment.

RIGHT: *Twin Disc Model E Heavy-duty Clutch.*
LOWER RIGHT: *Twin Disc Power Take-off.*

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC CLUTCH COMPANY • RACINE, WISCONSIN

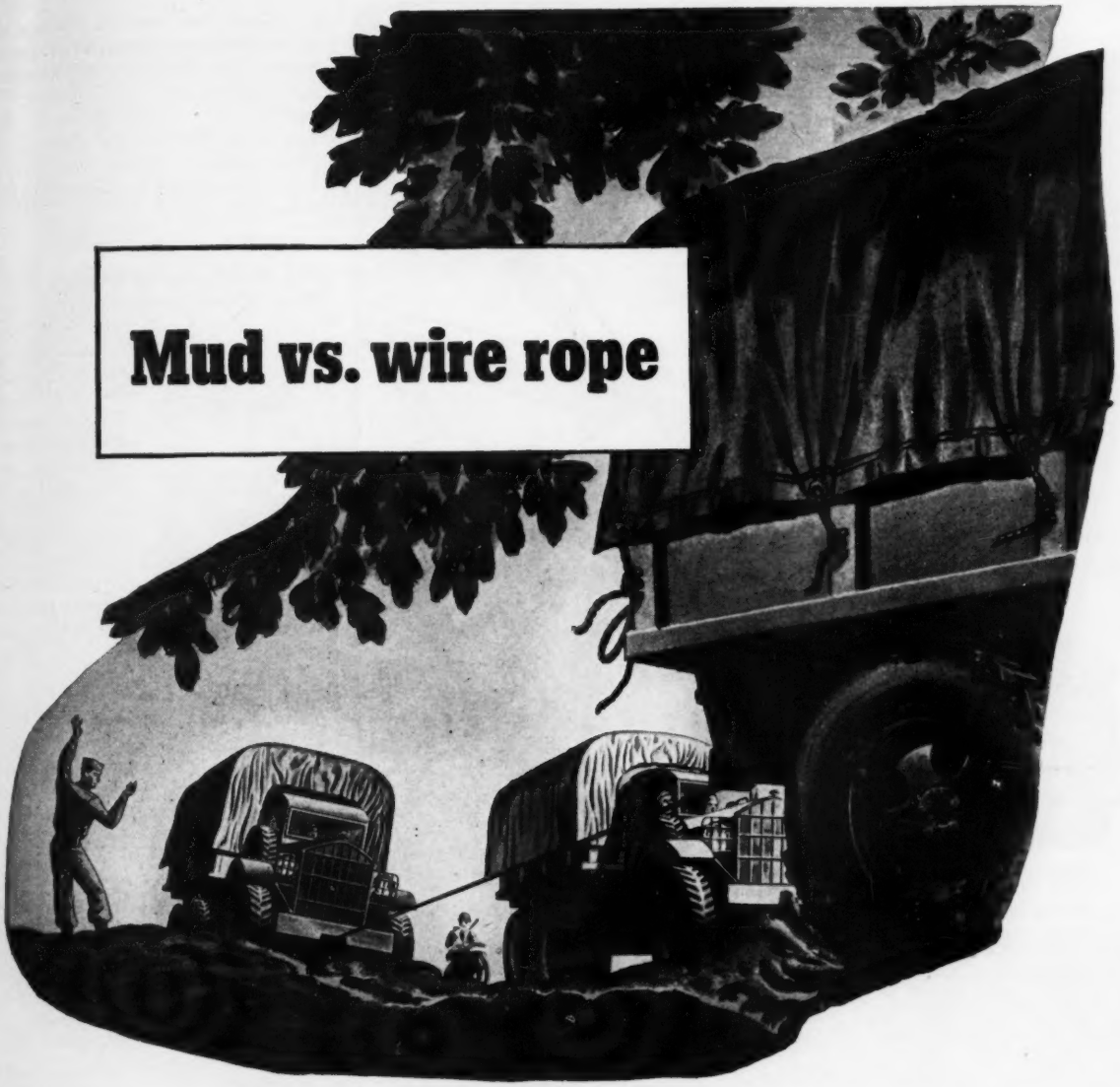
MANUFACTURERS' ACTIVITIES

J. C. COSTELLO has been appointed manager of Atlas Powder Co.'s Giant Division sales office, with headquarters at San Francisco, Calif. Mr. Costello succeeds Weston G. Frome, who has become assistant general manager of the explosives department located at Wilmington, Delaware. Mr. Costello has been associated with the explosives industry for 34 years, the past 22 with Atlas as assistant sales manager and sales manager of the Giant Division.

LAPLANT-CHOATE MFG. CO., INC., Cedar Rapids, Ia., has announced the appointment of Jack Redfern as district representative in the Pacific Northwest territory. Mr. Redfern will cover the states of Washington, Oregon, Idaho, western Montana and British Columbia, working closely with LaPlant-Choate "Caterpillar" distributors and their customers, in connection with the company's complete line of earth moving, land clearing and snow removal equipment. He will continue to make his headquarters in Seattle.

F. A. WEISENBERGER, manager of the Kansas City branch of the service-sales division of the Timken-Roller Bearing Co. for several years, has been made manager of the San Francisco branch to succeed F. H. Lindus, who has resigned. He had also served in the Pittsburgh office of the company before assuming charge of the Kansas City branch.

THE VAPOR RECOVERY SYSTEMS CO., of Compton, Calif., announces the following appointments as sales engineers: Clifford T. Stanhope is in charge of the eastern office and warehouse at 30 Church St., New York City; Frank M. Holloway, member of the A.S.M.E. and formerly eastern sales manager, will assume new duties as southeastern sales manager with headquarters at New Orleans, La.; John



Mud vs. wire rope

We can't stop the rains, but we *can* provide a means for pulling stalled jeeps, trucks and tanks out of the clutches of that obstinate and gluey old campaigner, General Mud.

Bethlehem's wire rope mill is producing many thousands of emergency winch cables, carried as standard equipment on trucks and tanks. We make up these cables complete, with fittings and hooks all ready to be used. Millions of feet of Bethlehem wire rope have already gone into this service.

Bethlehem Manufactures Wire Rope for all Purposes

HE CALLS HIMSELF SUPERWORKER, BUT I REALLY THINK IT'S THOSE EMPIRE BOLTS AND NUTS THAT ARE RESPONSIBLE FOR THE FAST ASSEMBLY WORK.

EMPIRE COLD-HEADED BOLTS*

STRONGER—Close-grained metal used; grain structure intensified by bolt-making processes and heat treatment.

TOUGHER—Cold-reduction of shank toughens skin surface for threading.

CLEANER—Threads *cold-worked;* strong, accurate, clean for quick assembly.

QUICKER—Point chamfered (60°) for ease in assembly.

*Up to ⅛" x 8"; larger sizes manufactured by another method.

EMPIRE NUTS*

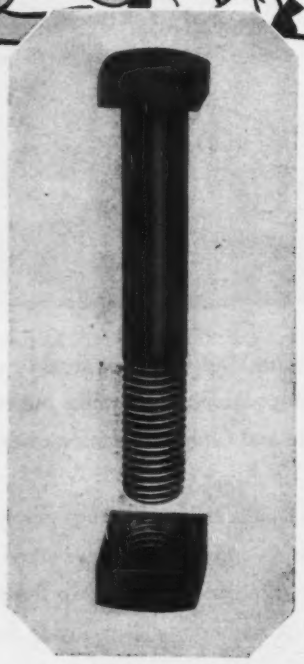
STRONGER—Hole is punched at *right angles* to grain — no splitting.

TOUGHER—Processed to guard against stripped threads.

CLEANER—Tapping is done with frequently-changed taps.

QUICKER—Accurate tapping means nuts run on fast; counter-boring of hole means quick get-away.

*Regular nuts are processed cold through ⅜".



EMPIRE and allied fastening products since 1845

RB&W *Making strong the things that make America strong*

RUSSELL, BURDSALL & WARD BOLT & NUT COMPANY

Factories at Port Chester, N. Y., Rock Falls, Ill., Coraopolis, Pa.

Sales offices at Philadelphia, Chicago, Detroit, Chattanooga, Los Angeles, Portland, Seattle

L. Shaunty has been appointed manager of mid-continent sales, distribution and service. He will have complete charge of both Houston and Tulsa offices and warehouses: A. J. Foley & Co., 7309 East End Ave., Chicago, Ill., have been appointed representatives in the Great Lakes area for the company's marine and sewage equipment.

H. J. BARNSLEY, vice president of Jenkins Bros., manufacturers of valves, has been elected to the governing board of Jenkins Bros. Ltd., Montreal, Canada. Mr. Barnsley joined Jenkins Bros. 25 years ago, coming from the Crane Co., where he was chief drafting engineer. Mr. Barnsley makes his headquarters at the company's New York City offices which are located at 80 White St.

P. R. GREENMAN has joined the Ludlow Valve Mfg. Co. as industrial sales engineer in the Chicago territory. Mr. Greenman is a mechanical engineer and designer of wide experience in power plant, oil refinery and coal handling equipment.

GEORGE JOHNSTONE, JR., formerly assistant foundry superintendent at the Grove City, Pa., plant of the Cooper-Bessemer Corp., has been promoted to foundry superintendent. Before joining Cooper-Bessemer, Johnstone served as foundry superintendent for William A. Hardy & Sons Co., Fitchburg, Mass. He was also instructor in foundry practice and technology at Girard College, Philadelphia, for several years.

LEWIS H. BROWN, president of Johns-Manville Corp., had conferred upon him the honorary degree of LL.D. at Brown University's commencement exercises June 2. President Henry M. Wriston of Brown's conferring the degree.

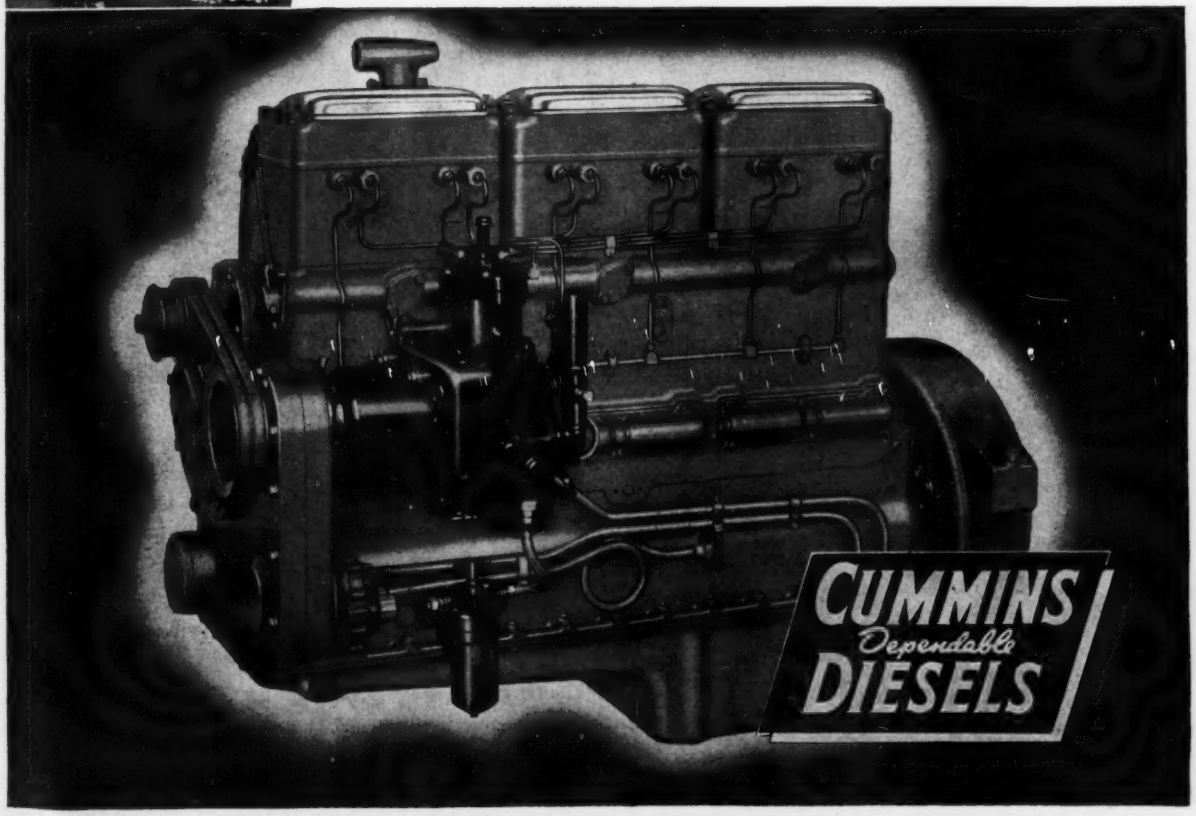
R. H. V. SMITH is sales manager of the Lawrence Portland Cement Company at 10 High Street, Boston, Mass., and is not connected with the Portland Cement Association, as was stated in error in an item which appeared in the June 17 issue of *Engineering News-Record*.

A NATURAL
for any job

No matter what the service—construction, heavy-duty trucking, mining, logging, oil well drilling, generating, marine power—Cummins Dependable Diesels are a *natural*. A *natural* because Cummins Diesels have proved their ready adaptability . . . their consistent, long-time dependability . . . their over-all economy, in the widest variety of applications . . . automotive . . . industrial . . . marine.

It is this record of proved performance in every heavy-duty service which explains today's demand for Cummins Dependable Diesels . . . that's why every Cummins Dependable Diesel is tagged for some essential war job that demands power of unquestioned reliability. Cummins Engine Company, Columbus, Indiana.

Model HBI-600 Cummins Dependable Diesel. 150 hp. at 1800 rpm.



WYTEFACE
"A"
TRADE MARK
STEEL TAPES

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EASY-TO-READ, *raised* black graduations on crack-proof white surface . . . resist abrasion from rock, sand, scraping over rails, pipe, concrete, etc. In all sizes and types—in cases or reels. Ask your dealer—or write for catalog.

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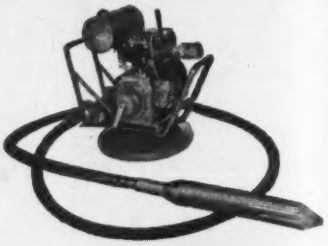
All About Rubber—Rubber has caused more comment and more speculation, perhaps, than any other commodity since the start of the war. With this in mind, the manufacturers have published a booklet entitled "Crisis in Rubber." It presents the very interesting story of synthetic rubber.—*B. F. Goodrich Co., Akron, Ohio.*

Creosoted Wood Products—The manufacturers have just published a catalog covering their entire line of creosoted wood products. It is well illustrated, showing typical applications and giving the characteristics and specifications of the various products, including creosoted wood blocks for flooring, creosoted poles, piling, timbers, posts, cross arms, ties, etc.—*Republic Creosoting Co., 1602 Merchants Bank Building, Indianapolis, Ind.*

Lathe Catalog—A new catalog devoted to lathes has been issued by the manufacturer. This 12-page, file size catalog illustrates and describes both the bench and metal column base types available in three models. These lathes are designed for machining small accurate parts on production, toolroom and general work. To facilitate their selection, tabulated specifications give complete information on capacities, feeds, speeds and dimensions.—*South Bend Lathe Works, South Bend, Ind.*

Proportioning Equipment—An 8-page bulletin is announced describing the latest developments in proportioning and sampling equipment. Construction, operation and application of a new chemical proportioning pump are discussed. This is a synchronized drive chemical pump used in the solution of proportioning problems in the petroleum and water conditioning industries. This latest design pump has widened the scope of application to all industries where reciprocating pumps are used in processes requiring proportioning.

Dependent only upon the pressure



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1200' assembled pipe (132 Tons) were lowered to bed of Mississippi at St. Paul with 9—5-Ton Beebes, three lines to each hoist through blocks.
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Longest wooden trusses in world were installed with ONE 5-Ton Beebe after power hoists proved impractical.

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When raising, lowering, or placing costs by power are a serious problem, the answer is the right number of Beebe Bros. All Steel Hand Hoists MANNED IN UNISON. Available in 2, 5 and 15 Ton sizes. Sold through leading dealers in all trade centers. List of dealers sent upon request.

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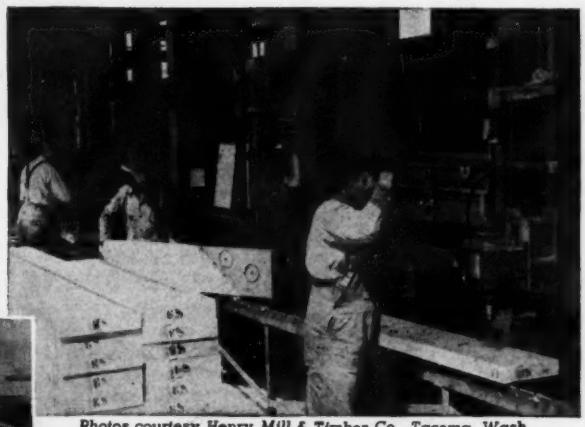
"THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WORLD"

PREFABRICATED TIMBER .... *precision cut*

and quickly assembled .... economical and permanent

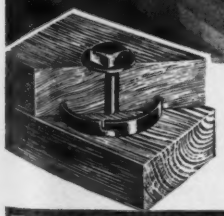
Timber trusses engineered under the TECO Connector System are trim, efficient, and serviceable.

Power tools pre-groove the timbers to precise dimensions to receive the TECO Connectors which are imbedded in the joints.



The pre-grooved timber members are assembled. The invisible TECO Connectors assure strong and rigid joints.

Photos courtesy Henry Mill & Timber Co., Tacoma, Wash.



The **TECO** Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.

The TECO Connector System of timber prefabrication makes it possible to employ timber successfully in heavy structural engineering. Many great war plants, shipyards, docks, warehouses, hangars, bridges, and towers have been built entirely of timber under the TECO Connector System. Scores of them have been Army or Navy installations. From the raw lumber to the finished truss, every step in modern prefabrication is controlled by sound engineering practices and precision methods. A high degree of speed and economy have resulted. Write today for our literature, using your firm letterhead.

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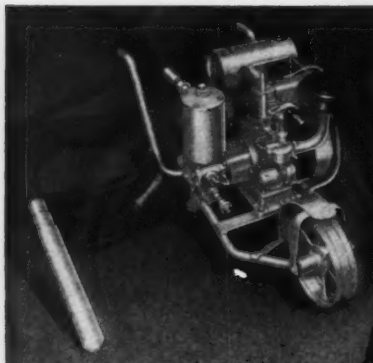

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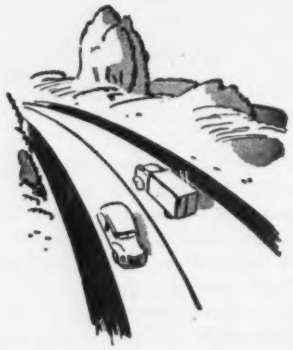

As an emergency measure, highway widening can provide adequate capacity for handling traffic flow increased by defense activity. This saves the delay and expense of constructing new roads which may or may not be required in normal times.

Asphalt construction offers the fastest and simplest method of getting results. Not only can it use local aggregates, but Asphalt can be laid with little interference to traffic.

Wherever Standard Oil Asphalt products are sold, there is an Asphalt Representative who can give you full information about these and other uses of Asphalt. Write . . .

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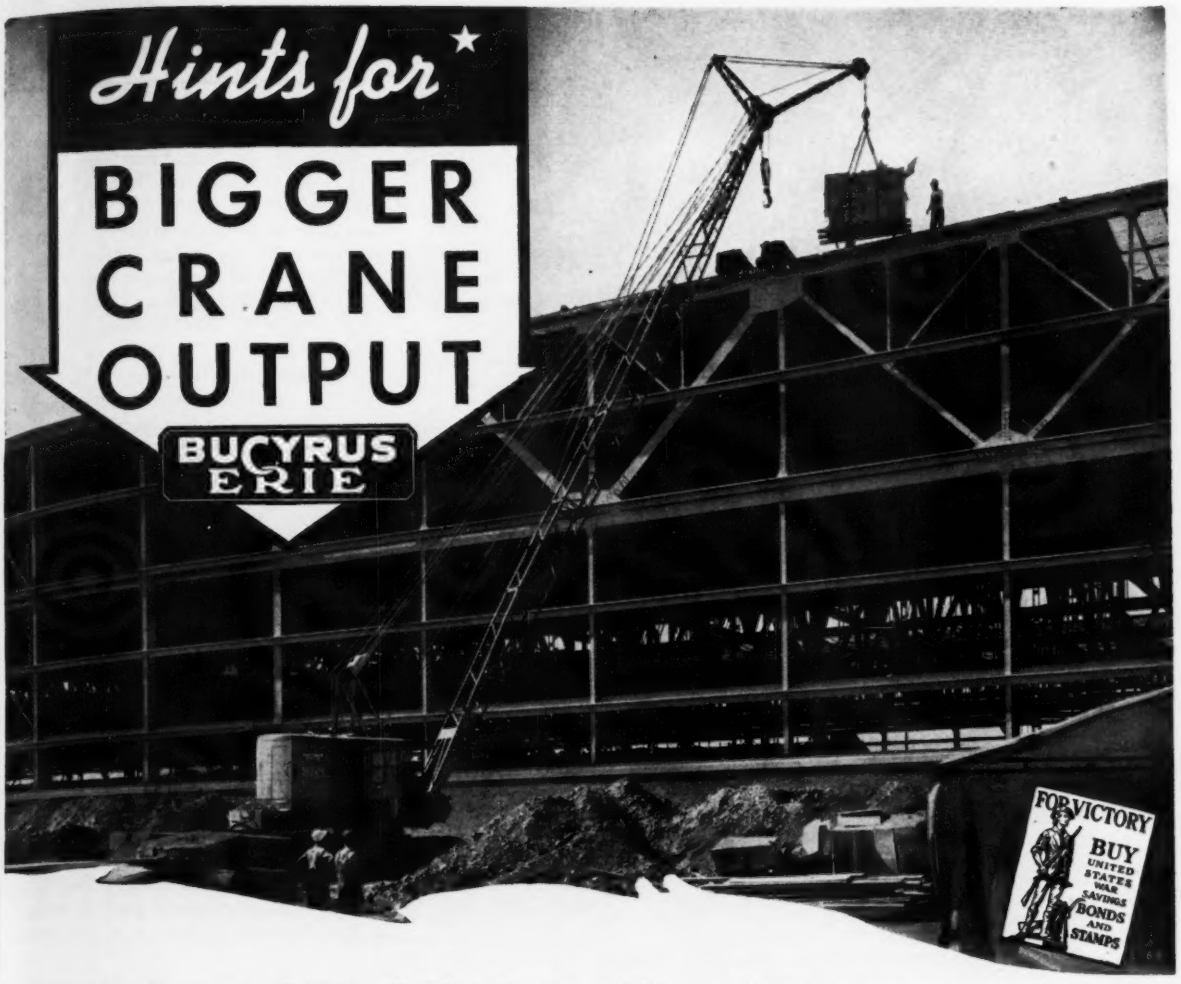
surges developed by a master reciprocating pump, the pump is otherwise entirely self-contained. Complete dimensions, capacities and operating data, together with a thorough discussion of the unique valve and packing construction are presented.—*D. W. Haering & Co., Inc., 205 West Wacker Drive, Chicago, Ill.*

Pumping Equipment—Recent developments have opened new fields for modern pumping equipment. Water and other liquids must be moved in increasing volumes, at greater speeds and with higher efficiency to satisfy these requirements. The object of this bulletin is to make available to those responsible for the specification and and purchase of pumping equipment factual data regarding the various types of pumps included in this manufacturer's line.—*The Deming Co., Salem, Ohio.*

Templates for Pipe Fitting—A new 12-page booklet, "Pipe Templates for Welded Fittings," tells how to fabricate fittings for welded piping installations by means of flame-cutting and welding. The booklet shows how to draw up and use paper templates for flame-cutting pipe to assure accurate, close fitting connections. The templates and procedures described are intended primarily for use where special fittings are required or where stock welding fittings may not be available when needed. Although standard welding fittings are generally most economical and efficient, occasions arise where it is more advantageous for a user to fabricate his own fittings. In such cases the methods outlined in this booklet will save guesswork and spoilage and help assure efficient fabrication.—*G. Van Alstyne, Air Reduction, 60 East 42nd St., New York, N. Y.*

Portable Gravel Plant—A bulletin consisting of 10 pages in two colors gives useful hints in selecting portable gravel plants and takes the reader step by step through the construction and operation of this particular plant. Flow charts and complete table of sizes and specifications with adequate illustrations of all parts and features are given.—*Diamond Iron Works, Inc., Minneapolis, Minn.*

Mounted Compressors—A 30-page catalog, besides giving a full description of the various models of mounted compressors and compressor welder combinations driven through a split propellor power take-off, also contains an interesting description of a pneumatic saw, which is driven by compressed air, and operated by two men.—*Davey Compressor Co., Kent, Ohio.*



Here are a few simple hints that may help you increase your crane output:

1. Be sure footing is good. A little extra time spent preparing good footing will be more than repaid by increased speed, steadiness and safety of operation. Remember not to let the side of the machine toward the load be low.
2. Do not exceed stability ratings; do not operate with boom angle greater than 78° to horizontal.
3. Accurate control means speed. Keep brakes and clutches in proper adjustment.
4. Use sufficient parts of line to insure needed accuracy of control, combined with minimum stress on the machine.
5. Do not propel machine while boom is at high angle.
6. If you have to move with a load in soft going, the cats will "climb" better if you move with the load behind. Don't travel with close-to-maximum loads.
7. If you move with a load, it should be snubbed to the machine to prevent it from swaying.
8. Set up a regular schedule for inspection and lubrication.

ARMY E NAVY

Bucyrus-Erie employees have accepted the award of the Army-Navy "E" as a challenge to keep production rising. • •

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Now, for the first time, it is easy to measure strain resulting from changes in the loads on bridges and other structures as each member is put in place. By placing SR-4 Strain Gages, the simplest and most accurate instruments ever built to measure stresses, at a number of points on each member, it is possible to record every change that takes place in load distribution of a structure under construction.

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MEN AND JOBS

Charles H. Sweetser, U. S. District Engineer at San Francisco for California, Arizona and Nevada, has been retired at the age of 70. Mr. Sweetser was a former state highway engineer of Washington in charge of the San Francisco office of the Department of Public Roads for thirty years. He is succeeded by Charles C. Morris.

William B. Hunter, of Lillington, N. C., former county health officer of Harnett County, has been commissioned a major and has reported for field duty with the armed forces.

Captain C. E. Lee, Pueblo, Colo., member of the Army Engineer Corps, has been placed in charge of the Trinidad and La Junta, Colo., areas and **Capt. E. A. Francis,** former area engineer at La Junta has been assigned to the Pueblo office to assist Capt. Lee. **Capt. Harry D. Burton,** formerly area engineer at Trinidad, Colo., has been named acting engineer for the proposed Modification Center for Denver County.

Frank M. Limbaugh, district highway engineer at Albuquerque, N. M., has been named state highway engineer of New Mexico to succeed **Burton Dwyre,** who resigned to accept a position with the Pan-American Airways in South America.

Elmer K. Nelson, who has served 13 years as city engineer for Laramie, Wyo., has resigned to accept an assignment with the War Department and will be located at Sacramento, Calif.

Rufus C. Burleson, engineer for the utility supervisor's office, Dallas, Tex., has been commissioned a captain in the anti-aircraft division of the coast artillery at Galveston, Tex.

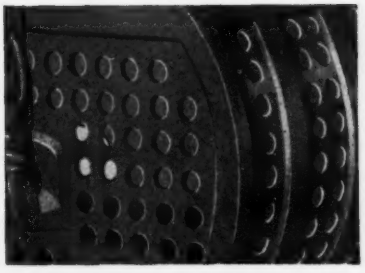
First Lieut. Gerald W. Long, U. S. Army Engineers, is project engineer in charge of between $750,000 and $1,000,000 worth of construction and improvement work on the Smith-Reynolds airport at Winston-Salem, N. C. The work is being done under the supervision of the Wilmington, N.C. District Engineer Office and is directed by **Maj. L. A. Wilson,** area engineer at Greensboro, N. C.

William F. Fowler, camouflage officer for the U. S. Army District Engineer Office at Wilmington, N.C., since April 1, has been promoted to the rank of captain from that of first lieutenant.

City Engineer Ralph W. O'Neill, of

Lightweight*

THE PERFORATIONS DO THE TRICK!



The perforations in Hendrix Buckets serve a three-fold purpose, the first is the reduction of bucket weight. Second, they eliminate vacuum and insure a quick, clean dump. Third, in wet digging, they let the water remain in the pit so that the operator gets a full load of pay material every trip. Perforations are round to eliminate the hazards of breaks and are so arranged that the strength of the bucket walls is not impaired.

*means bigger pay loads!

That's just what it means. Hendrix Lightweight Buckets are 20% to 40% lighter than other buckets, type for type, permitting the use of a larger bucket than that for which your machine was designed, yet maintaining the allowable loaded weight. This also permits the use of a larger bucket on operations requiring a long boom. In wet digging you step-up pay loads by leaving the water in the pit.

Don't get us wrong . . . we've sacrificed none of the bucket's strength or durability. Every Hendrix bucket is designed and built in accordance with sound engineering principles and into each one go the qualities which assure years of trouble-free service. We simply eliminate all the excess weight . . . the load goes *inside* the bucket

Hendrix Buckets also available without perforations.

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GET IT INTO THE BATTLE!

HENDRIX *Lightweight* **DRAGLINE BUCKETS**

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At a large phosphate drying plant in Florida, wet rock is stored on the ground by a Sauerman Scraper and then after draining is reclaimed to the plant by the same scraper.

Concrete aggregate for a large dam is dug from river at site of dam by Sauerman Slackline Cableway while small Sauerman Scrapers handle stockpiles between river and central mixing plant.

ON jobs where materials are to be moved distances of several hundred feet or more, a SAUERMAN Drag Scraper or Cableway has an advantage over other equipment because it is able to dig, haul and place the material in a continuous, straightline operation, doing away with the expense of rehandling. The operation is smooth and rapid, producing large yardage with moderate expenditure of power.

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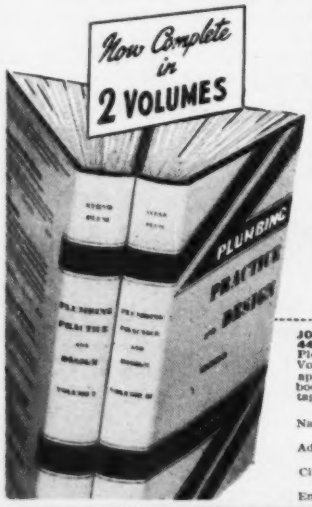

Volume I covers Corrosion, Materials, Pipes, Fittings, Valves, Controls, Fixtures, Pumps, Fire Protection, Air Piping, etc.

Volume II deals with Definitions, Regulations, Architectural Practice, Pipe Work, Water Supply, Drainage, Sewers, Gas Piping, Water Heating, etc.

Vol. I, 308 pages.....$4.50
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Youngstown, Ohio, has announced his candidacy for mayor, subject to the Democratic primary in August. Engineer O'Neill went to Youngstown in the 1930's as an engineer in charge of WPA work.

Harley C. Patton, Stafford Springs, Conn., has been appointed a member of the Connecticut Development Commission to fill the unexpired term of the late Francis C. Luce.

City Engineer George S. Bloomgren, East Liverpool, Ohio, has gone to Mexico on a three months' leave of absence to work for a commercial engineering firm. **Walter Henry,** assistant engineer, will be acting engineer during Mr. Bloomgren's absence.

Maj. Carroll L. Mann, Jr., of Raleigh, N. C., has been transferred from Fort Bragg, N. C., to Wilmington, N. C., where he has assumed his duties as executive officer of the Wilmington Army District Engineer Office, succeeding **Lt. Col. T. J. Knight** who recently was advanced to district engineer.

C. H. Wolfe, of Charlotte, N. C., superintendent of the Mecklenburg County Drainage Commission for the past 30 years, has resigned, effective July 1.

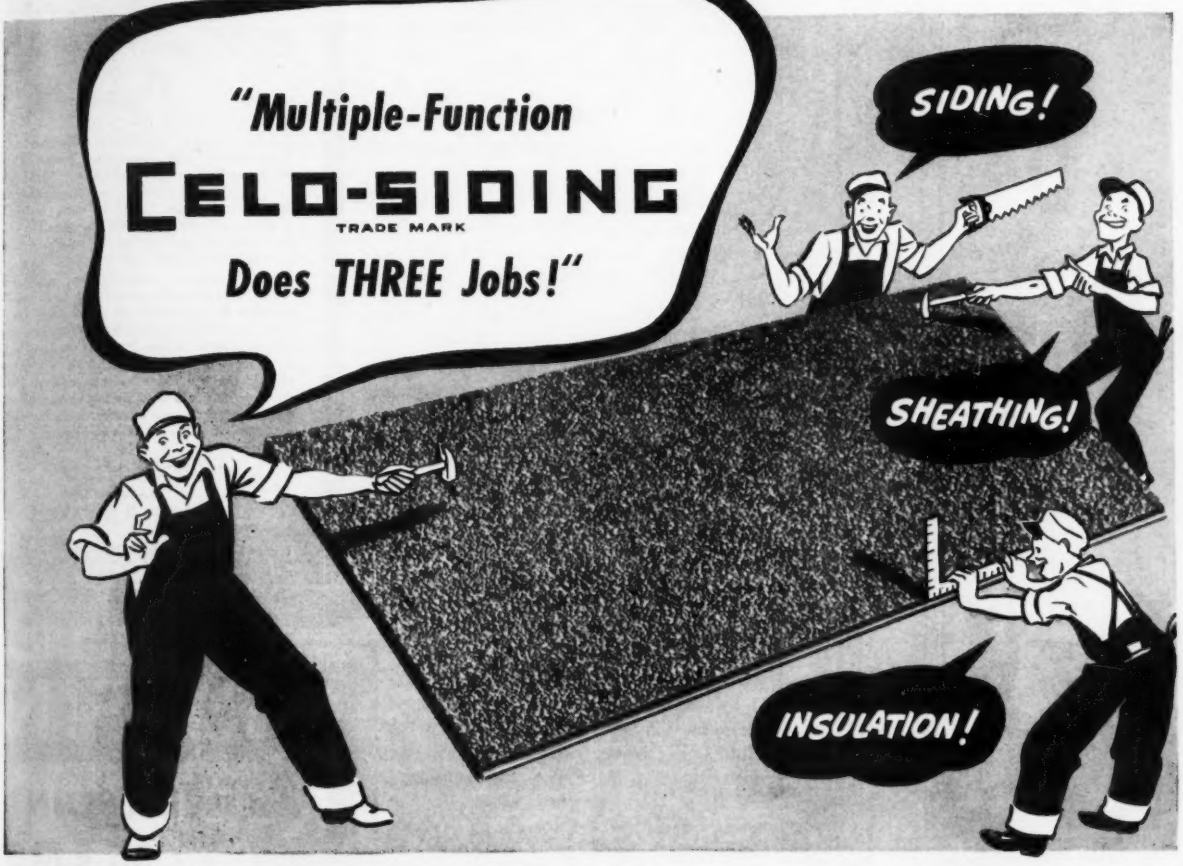
James S. Ritch, of Charlotte, N. C., civilian construction supervisor with the U. S. Army Engineers and formerly employed by the city engineering department at Charlotte, has just been appointed sanitary supervisor for the city of Charlotte.

William F. Freeman, High Point, N. C., consulting engineer, has been appointed a coordinator of inter-American affairs in South America. His headquarters will be in Rio de Janeiro and he will be associated with Dr. Herman G. Baity, formerly head of the University of North Carolina department of sanitary engineering, who has been serving with the U. S. Government in South America for several months.

Col. Caryle R. Hazeltine, Corvallis, Ore., has been named deputy chief of the Northwest Service Command, which operates the Alaskan military highway and other routes to the North Pacific area. Colonel Hazeltine succeeds Col. Harry A. Montgomery of Tulsa, Okla., who has been transferred to Washington, D. C. Hazeltine was graduated from Oregon State College as an engineer, and has been in the Army since 1921.

Steve C. Tate, of Tate, Ga., has been appointed chairman of the State Highway Commission of Georgia by Governor Arnall.

From open field to completion *Days Faster!*



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Colors and sizes! Celo-Siding comes in brown, buff or green. Units are ½" thick and 2' x 8' or 4' x 8', 9' and 10'. The 2' x 8' has T&G joints on long edges. The 4' widths have square edges all around. Each suitable for horizontal or vertical application. All joints to be sealed with caulking compound.

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MEETINGS

AMERICAN SOCIETY FOR TESTING MATERIALS, 46th annual meeting, Hotel William Penn, Pittsburgh, Pa., June 28-July 2.

AMERICAN SOCIETY OF CIVIL ENGINEERS, summer meeting, Biltmore Hotel, Los Angeles, Calif., July 28-30.

REGIONAL AND LOCAL MEETINGS

WISCONSIN COUNTY HIGHWAY COMMISSIONERS AND COUNTY HIGHWAY COMMITTEE MEMBERS meeting, Wausau, Wis., July 14-16.

NORTH CAROLINA LEAGUE OF MUNICIPALITIES, annual meeting, Raleigh, N. C., Aug. 12-13.

NEW ENGLAND WATER WORKS ASSOCIATION, Hotel Statler, Boston, Mass., Sept. 28-29.

Elections and Activities

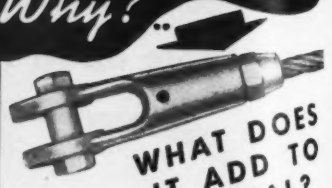
W. W. MITCHELL, director of the state highway department, has been elected president of the Arkansas Engineers Club. Other officers are: G. A. Wilkins, vice-president; Mike Thomas, secretary; and R. A. Kern, steward. Elected to the board of directors were E. F. Nelson, chairman; J. M. Page, F. I. Brown, F. A. Gruver and Col. A. M. Neilson.

J. GORDON JONES has been elected president of the Engineering Professions Club, of Jacksonville, Fla. Leon Frank has been elected vice-president; Frank Robinson, treasurer, and D. O. Foshee program director.

A. O. DUFRESNE, deputy minister of the Quebec Provincial Department of Mines, has been elected president of the Corporation of Professional Engineers of the Province of Quebec; vice-president, C. C. Lindsay; secretary-treasurer, A. D. Ross; councillors, J. A. McCrory, P. E. Poitras, J. O. Martineau, E. A. Ryan, A. Laframboise.

W. H. M. LAUGHLIN, designing engineer with the Dominion Bridge Co. Ltd., has been elected chairman of the Toronto branch of the Engineering Institute of Canada. S. H. DeJong was re-elected secretary-treasurer and the new directors are F. J. Blair, E. G. Hewson, C. F. Morrison, R. F. Legget, A. Hull and E. Cross.

A POSITIVE GRIP
Why?



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Many other advantages, such as greatly increased wire rope life, elimination of hazards to workmen, etc., have made these connectors first choice for dependable results. Let us send you an interesting booklet, "Positive Grip". It will give you complete performance data on this easily installed, better and more economical streamlined connector. Write today.

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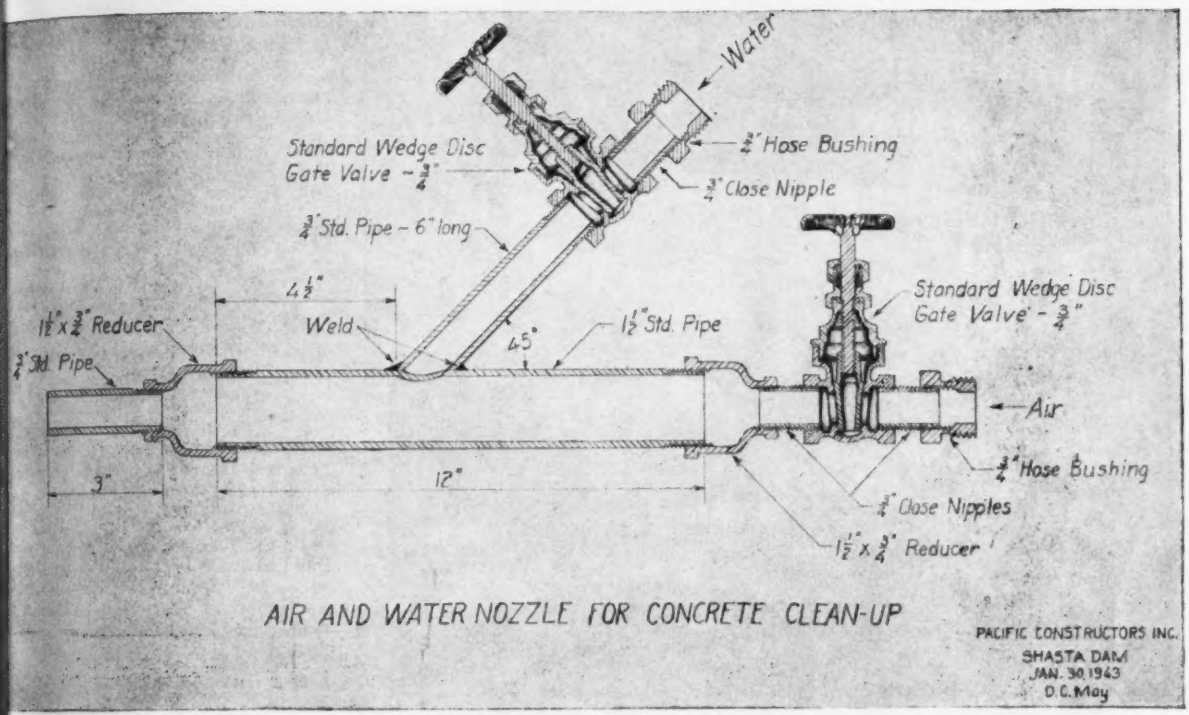
Concrete has its face washed with air and water



The top of the concrete block in a dam, which becomes the construction joint, must be thoroughly cleaned before pouring on the next lift of concrete. At Shasta Dam, this cleaning operation was performed in two steps. First by sandblasting, which left considerable debris. This was removed by a water nozzle which flushed out the debris. Then the air nozzle cleared off the puddled water. As the drawing shows, these air and water nozzles can be made in any small shop from "junk pile" materials. They will operate satisfactorily on a wide range of pressures.

This reproduction is one more example of working drawings made with Dixon *Typhonite ELDORADO pencils. A 3H was used for line work. The lettering made with a 2H, and an H for the shading. Note the fact that, despite much cross-hatching in the production of the working drawing, the triangle did not smear the *Typhonite* ELDORADO lines.

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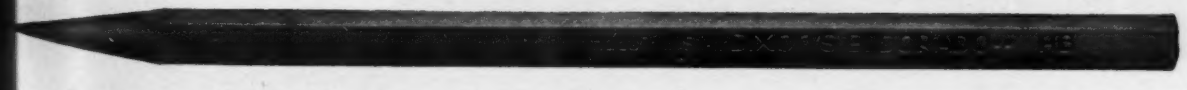

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Reports and Pamphlets

(*Continued from page 96*)

HARTFORD, CONN.—Twelfth Annual Report of the Water Bureau.

RICHMOND, VA.—Annual Report, Director of Public Works, 1942.

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA—Fourth Annual Report, 1941-1942.

CAMBRIDGE, MASS.—Annual Report of the City Engineer, For the year ending Dec. 31, 1941.

ISABELA IRRIGATION SERVICE—Annual Report of the Chief Engineer, San Juan, P. R.

HONOLULU—Ninth Biennial Report of the Board of Water Supply, 1941-1942.

STREAM FLOW RECORDS OF PENNSYLVANIA—Year Oct. 1, 1940 to Sept. 30, 1941. Department of Forests and Water, Harrisburg.

THE FLOOD OF JULY 1942 in the Upper Allegheny River and Sinnemahoning Creek Basins. Pennsylvania Department of Forests and Water, Harrisburg.

EFFECT OF TIME OF HAUL on Strength and Consistency of Ready Mixed Concrete—By Glenn C. Cook. National Ready Mixed Concrete Association, Washington, D. C. 6c.

BOMB-RESISTANT AIR RAID SHELTERS—A report from the *Proceedings* of the American Concrete Institute. By Harold E. Wesseman. Journal of the American Concrete Inst., Detroit.

A GUIDE TO THE PREVENTION OF WEIGHT-LIFTING INJURIES—U. S. Department of Labor. Special Bulletin No. 11. Superintendent of Documents, Washington, D. C. 10c.

A REVIEW OF RAILWAY OPERATIONS IN 1942—Association of American Railroads Bureau of Railway Economics, Washington, D. C.

SOUTH JERSEY PORT COMMISSION—Seventeenth Annual Report.

HENNEPIN COUNTY, MINNESOTA—Financial Statement, 1942.

HONOLULU, HAWAII—Annual Report of the Department of Public Works, 1942.

SOUTH DAKOTA STATE BOARD OF ENGINEERING AND ARCHITECTURAL EXAMINERS—Ninth Biennial Report. Period ending June 30, 1942.

NEW YORK DEPARTMENT OF HEALTH—Sixty-second Annual Report, 1941.

LYNCHBURG, VIRGINIA—Annual Report, 1942.

LARCHMONT, NEW YORK—Annual Report, 1942.

THE ENGINEERING FOUNDATION—Annual Report 1941-1942. 29 West 39th St., New York.

THE NOVA SCOTIA POWER COMMISSION—Twenty-third Annual Report. Year ending Nov. 30, 1942.

CONSTRUCTION REPORTS

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York
ELSIE EAVES, Manager *SCOTT McLEOD, Statistician*
(Daily service also available—Write for details)

WATER SUPPLY

PROPOSED WORK

†**Conn., New Britain**—City Bd. Water Comrs., City Hall, 2 pipelines, Conn. 6-165. Over $15,000. **FWA.** G. Molleur, city engr.

†**Florida**—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, architectural engineering services by Russell & Axon, Jacksonville, for water and sewage facilities, Contr. 436-eng-10213, Hillsborough Co.

★**Mich., Detroit**—Dpt. Water & Supply, 735 Randolph St., Detroit, 7 mi. 16- to 72-in. water supply lines. $1,037,000. **FWA.** L. G. Lenhardt, 735 Randolph St., supt. Dpt. Water Supply.

Mont., Shelby—WW sys., $100,000. Corwin & Co., Great Falls, engrs.

†**Tex., La Marque**—Galveston Co. Water Control & Imprvt. Dist. 3, c/o B. Duselman, addnl. water and sewerage sys., Tex. 41-265, $344,143. **FWA.** J. J. Rady, Insurance Bldg., Fort Worth, engr.

Wis., Waukesha — The Borden Co., 1171 Riverside Dr., cooling tank, pumps, piping, etc., $25,000.

N. S., Yarmouth—Municipality, E. H. Spinney, mayor, laying new pipeline from Lake George. $450,000. J. R. Kaye, Engineering Services, Ltd., 14 Prince St., Halifax, engr.

Sask., Moose Jaw—Municipality, water supply from the Saskatchewan River. $50,000.

Sask., Regina—Municipality, water supply from the Saskatchewan River.

BIDS ASKED

Bids Asked July 6

O., Berea—R. Kobie, dir. P. Serv., City Hall, underpinning buildings, tanks of water purification plant. Bids June 14 rejected. Finkbeiner, Pettis & Strout, Nicholas Bldg., Toledo, engrs. CD 6/11.

Bids Asked July 8

D. C., Wash.—District Comrs., District Bldg., 24 in. trunk watermain from reservoir in Fort Stanton Park to Alabama and Nichols Ave. S.E. Plans deposit $10 each set.

N. Y., New Windsor—Town Bd. At office Mrs. Catherine Nee, town clk., water sys. Morrell Vrooman, Gloversville, consult engr.; adv. ENR 7/1.

Bids Asked July 20

†**Tex., Amarillo**—Veterans Admin., Vermont Ave., between H and I Sts. N.W., Wash., D. C., drilling deep water supply well, pump unit, pump house, etc. Extended date. CD 6/3—ENR 6/17.

Bids Asked July 26

†**N. Y., Farmingdale**—Bd. Village Trustees, Village Hall, 361 Main St., gravel wall type well, pump. sta. and connecting pipelines, equipment, appurtenances. Docket N.Y. 30-219. **FWA.** Plans deposit $10. Buck, Seifert & Jost, 112 E. 19 St., New York, consult. engrs.; adv. ENR 7/1.

LOW BIDDERS

N. Y., Hudson—Dpt. P. Wks., City Hall, June 15, water pump. sta., appurtenant imprvs., from Lange-Finn Constr. Co., 529 Bway. Albany, **$50,856.** CD 6/2—ENR 6/10.

CONTRACTS AWARDED

†**California**—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, reservoir repairs, Contr. 509-Eng-5084, Santa Barbara Co., to Flotation Systems, Inc., 4031 Goodwin Ave., Los Angeles, under **$50,000.**

†**California**—U. S. Eng., 1209-8 St., Sacramento, water, gas, sanitary sewer and electrical distri. sys., facilities, Contr. 1105-Eng-5065, Contra Costa Co., to Stolte, Inc., 1405 San Antonio Ave., Alameda, under **$50,000.**

†**Florida**—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, furnishing, laying water distr. lines, water service lines, sewer pipe, install gate valves, erect elevated water storage tank, etc., Contr. 436-Eng-10175, Sumter Co., to Stanfield Constr. Co., Tampa, under **$50,000.**

Kan., Coffeyville—Watermains, to Cement Asphalt Products Co., Coffeyville, **$24,312.** Bids 6/2.

†**Montana**—U. S. Eng., 300 3 Ave., Seattle, Wash., water distr. sys., Glacier Co., to Utility Builders, Great Falls, under **$50,000.**

†**North Carolina**—U. S. Eng., 308 Customhouse, Wilmington, reservoir and piping for water treatment plant, Contr. 982-Eng-1862, Richmond Co., to Higgins & Gaines, Greensboro, under **$50,000.**

†**Oklahoma**—U. S. Eng., 416 Wright Bldg., Tulsa, enlarging water treatment plant, Contr. 957-Eng-1941, Muskogee Co., to F. E. Chalender, t/a Chalender Constr. Co., Springfield, Mo., under **$50,000.**

†**Texas**—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., water wells, Contr. 957-Eng-1946, Dallam Co., to Layne-Texas Co., Ltd., 3901 Elm St., Dallas, **$50,000-$100,000.**

†**Texas**—U. S. Eng., Alburquerque, N. M., addnl. water facilities, Contr. 911-Eng-2028, Ward Co., to R. H. Fulton & Co., Lubbock, under **$50,000.**

†**Texas**—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., wood stave water storage tank, Contr. 957-Eng-19336, Dallam Co., to John F. Perdue, t/a Perdue Tank Co., 211 S. Lorraine St., Wichita, Kan., under **$50,000.**

†**Texas**—U. S. Eng., Fort Sam Houston, steel, concrete elevated water tank, McCulloch Co., to V. Prassel, 808 Builders Exchange Bldg., San Antonio, under **$50,000.**

†**Washington**—U. S. Eng., 300 3 Ave., Seattle, water control sys., Spokane Co., to Consolidated Electrical Contractors, 619 W. 1 St., Spokane, under **$50,000.**

Location of ENR Correspondents.

Symbols and Abbreviations Include:

† Federal Government
★ Project of $500,000 or over
ENR Engineering News-Record
CD Engineering News-Record Construction Daily
A-E-M Architect—Engineer-Management type of contract.

Projects—By Site

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply	Unclassified
Sewers, Waste Disposal	Latin America
Bridges	Public Buildings
Streets & Roads	Commercial Buildings
Earthwork, Waterways	Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads);
BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR);
LOW BIDDERS: On jobs below $500,000 value all low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.
CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

Note: To comply with censorship requirements, addresses on some reports are being generalized. Data which would reveal the purpose of the improvements and the size are withheld. The name of contractor and general area are reported.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

†**Conn., Bridgeport**—City Hy. Comn., City Hall, Contr. 5, siphon sewer under Johnson's Creek, Contr. 6, trunk sewer Seaview and Connecticut Aves., Conn. 6-107. Over $25,000. **FWA.** H. L. Rowland, City Hall, engr. CD 6/1—ENR 6/10.

N. Y., Geneva—Dpt. P. Wks., City Hall, bids soon, sanitary sewers. $40,000. J. W. Brennan, c/o Dpt. P. Wks., City Hall, engr.

†**R. I., Middletown**—Town, c/o R. C. Adams, chmn. Sewer Com., sewerage sys., West Main Rd., to connect at Anchorage, R.I. 37-148, $36,000. **FWA.** Jenks & Ballou, 2600 Industrial Trust Bldg., Providence.

★**Tex., San Antonio**—City, G. B. Mauermann, mayor, Proposal 1, short main collection line, $40,000; Proposal 2, sanitary sewer sys. imprvs., supplemental disposal plant units, etc., $440,000; Proposal 3, sanitary sewerage sys. collection mains, $750,000. FWA funds applied for. T. Coghill, City Hall, engr.

BIDS ASKED

Bids Asked July 9

†**N. Y., Colonie (br. Albany)** — Town Bd. Colonie, at Town Hall, Newtonville, sewers, c.i. force main, sewage pump. sta. for Latham Sewer Dist., Proj. N.Y. 30-244. Plans deposit $25. Solomon & Keis, 257 Bway., Troy, consult. engrs., FWA. adv. ENR 7/1.

Bids Asked

Man., Portage La Prairie—Secy. Dpt. Munitions & Supply, Ottawa, Ont., sewage disposal plant at No. 7, A.O.S. for Dpt. Natl. Defense (Air), Ottawa, Ont. About $30,000.

LOW BIDDERS

†**California**—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, June 23, sewage disposal plant, water pump and house, reservoirs, etc., Kern Co., from H. O. Bauerle, 220 E. Valley Blvd., El Monte, over **$40,000.**

Calif., Los Angeles—City, City Hall, June 16, sanitary sewer in Hatteras St. and Camelia St. Sewer Dist., from B. Bosnyak, 2215 Shoredale Ave., **$39,937.** Est. $31,643.

†**Tenn., Memphis** — City, c/o W. Chandler, mayor, Court House, May 11, Nonconnah Basin Interceptor Sewer, 9.8 mi. long, using 36 and 48 in. concrete pipe, Docket Tenn. 40-242-NF, from F. D. Harvey, 688 S. Bellevue St., Memphis, **$305,533. FWA.** CD 5/4.

†**Texas**—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., Lot 3, sewage disposal plant, Sol. 959-Neg-42-303, Dallam Co., from Williams & Whittle, 5422 Mockingbird Lane, Dallas, **$50,000-$100,000.** CD 6/22—ENR 6/24.

CONTRACTS AWARDED

†**California**—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, sewage collection, underground water and gas distr. and road sys., Contr. 509-Eng-5053, Los Angeles Co., to Pacific Pipeline Constr. Co., 8732 Juniper St., Los Angeles, **$100,000-$500,000.**

Conn., Bridgeport—City Hy. Comn., City Hall, 3,640 ft. 8- to 21-in. sanitary and storm sewers in Thorne and Ruth Sts., 4,010 ft. 8- to 18-in., Clark St., 470 ft. 10-in. storm sewer, Old Town Rd., to City Constr. Co., Inc., 955 Main St., Bridgeport, **$39,821.** CD 6/4—ENR 6/10.

†**Florida**—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, sewage pump. station, manholes, etc., Contr. 436-Eng-10164, Levy Co., to Gabel Constr. Co., 216 Graham Bldg., Jacksonville, under **$50,000.**

†**Georgia**—U. S. Eng., Post Office Bldg., Savannah, sanitary sewer and water distr. sys. extens., Contr. 819-Eng-1570, Thomas Co., to J. B. McCrary Co., Inc., 22 Marietta St., Atlanta, under **$50,000.**

†**New York**—U. S. Eng., Chimes Bldg., Syracuse, incinerator bldg., with water, sewer, electric connections and service road, Contr. 321-Eng-923, Jefferson Co., to John J. Harvey Co., 2242 Whitesboro St., Utica, under **$50,000.**

†**New York**—U. S. Eng., 120 Wall St., New York, Zone 5, addnl. sewage facilities, Contr. 1097-Eng-4104, Richmond Co., to John Milnes Co., 201 Richmond Terrace, Port Richmond, under **$50,000.**

†**Oklahoma**—U. S. Eng., 231 W. Main St., Denison, Tex., drainage facilities, Contr. 257-Eng-2352, Jackson Co., to O. J. Parrott, 403 S. Haskell St., Dallas, Tex., **$50,000-$100,000.**

†**Texas**—U. S. Eng., 416 Wright Bldg., Tulsa, Okla., sewage disposal plant, Contr. 957-Eng-1949, Dallam Co., to Williams & Whittle, Inc., and Williams & Broughton, Inc., 5422 Mockingbird Lane, Dallas, under **$50,000.**

†**Virginia**—U. S. Eng., Fort Norfolk, Norfolk, surface drainage, Contr. 616-Eng-2512, Eliza-

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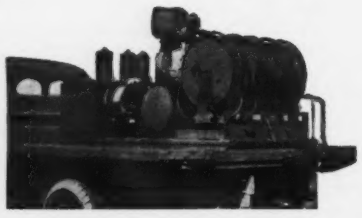

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SEWERS (Contracts Awarded, Cont'd.)

beth City, Co., to Laxton Constr. Co. Inc., 433 W. Morehead St., Charlotte, N. C., under **$50,000.**

†West Virginia—U. S. Eng., 925 New Federal Bldg., Pittsburgh, Pa., sewage treatment plant, sewage pump. sta., hy. crossing, etc. Contr. 1101-Eng-6'95, Berkeley Co., to A. J. Cole, Crystal Falls, Mich., **$50,000-$100,000.** CD 4/28 ENR 5/6.

BRIDGES

PROPOSED WORK

★**Tenn., Nashville**—F. Beasley, city engr., repairing 3 bridges over Cumberland River, paving, repairing streets, exten. storm sewers, $626,000.

BIDS ASKED

Bids Asked July 14

California—State Div. Hys., G. T. McCoy, ch. engr., Sacramento, 2 rein.-con. bridges across Pine Creek overflows, at 7 mi. west of Chico, Butte Co.

Bids Asked July 20

O., Cleveland—Bd. Comrs. Cuyahoga Co., G. H. Stahler, clk., Court House, bridge repairs, gunite concrete work, asphalt paving and approaches Green, Richmond and Warrensville Center Rd. bridges. **$41,000.** J. O. McWilliams, Standard Bldg., engr. CD 5/18—ENR 5/20.

LOW BIDDERS

Texas—State Hy. Dpt., B. P. Gentry, chn., Austin, June 22, reconstructing 2 sections of Lavaca Bay Bridge at Port Lavaca and making repairs to other portions of structure, 1.967 mi. Hy 35 SNA. FAP-1059-A(1), Calhoun Co., from Moore & Turner, Milam Bldg., San Antonio. **$402,632.** Est. $400,000. CD 6/14.

†Virginia—At office H. J. Spelman, dist. engr. Pub. Roads Admin., 1440 Columbia Pike, Arlington, June 18, Proj. VA DA WR 8, Bridge 15, War Department Building—Road Network, Arlington Co., from Guy H. Lewis & Son, McLean, **$58,005. FWA.** CD 6/4—ENR 6/10.

CONTRACTS AWARDED

N. J., Freehold—Monmouth Co., Court House, constructing Bridge W-7, Manasquan and Brielle, to A. P. Thompson, 87 Maple Ave., Red Bank, **$33,277.** Otis Seaman, co. engr.

STREETS AND ROADS

BIDS ASKED

Bids Asked July 6

N. J., Trenton—Mercer Co., Court House, furnishing, applying tar surface treatment 34 mi. roads. Plans deposit $5. H. Harris, co. engr.

Bids Asked July 7

N. J., Paterson—Passaic Co., Administration Bldg., penetration macadam paving east shore Greenwood Lake Rd. from Sts. 176 to 202, Greenwood Lake. Garwood Ferguson, Administration Bldg., engr.

Bids Asked July 8

Indiana—State Hy. Comn., S. G. Hadden, chn., Indianapolis, concrete paving 1.068 mi. road from 18 St. to U.S. Rd. 52, Tippecanoe Co.; 1.549 mi. State Rd. 63, Rural Dist., Vermillion Co.; 3.2 mi. State Rd. 63, south of Newport, Vermillion Co.; erosion control 4.578 mi. State Rd. 534, Marion Co.; 6.2 mi. State Rd. 431, Marion and Hamilton Counties. Plans deposit $2.75 each project. R. Bower, c/o owner, engr.

†Tennessee—Tennessee Valley Auth., Knoxville, C. H. Garity, dir. Purchases, clearing, grading, protecting slopes, building pipe and box culverts, gravel or chert surface courses 6.5 mi. roads in Kentucky Reservoir area, west of Linden, along Tennessee River and Tennessee Hy. 20; adv. ENR 7/1.

Virginia—State Dpt. Hys., Richmond, 2.878 mi. gravel road with hot asphaltic concrete surfacing and 0.138 mi. gravel road with chl. treatments, Routes 613, 617 and 637, SP DA-WR-1283-G, FP DA-WR 23 A(1), Fairfax Co.; concrete sidewalk 1.445 mi. Route 244, Proj. 1148 A-1, SW-1, Arlington Co.; concrete paving 0.428 mi. Route 337, S. P. DA-NR 1277-M-10 F. P. DA-NR 46-A(1), Norfolk Co. Plans deposit $5.

Bids Asked July 9

Minnesota—State Hy. Dpt., St. Paul, imprv. SP 6805-02 (Trunk Hy. 32-32) between South Roseau Co. line to TH 11 in Greenbush, 30,600 cu.yd. stabilized gravel base, 104,600 gal. bituminous material and 4,980 tons mineral aggregates; SP 1104-07 (TH 6-34) and SP 3106-05 (TH 6-34), near Remer, 5,800 cu.yd. subgrade excav., 6,640 cu.yd. stabilized gravel base, 16,300 gal. bituminous material and 775 tons mineral aggregate, Plans deposit 70c. each project; SP 8004-14 (TH 71-4), between Wadena and Sebeka, 1,900 cu.yd. subgrade excav., 6,000 cu.yd. stabilized gravel base, 13,600 gal. bituminous material and 650 tons mineral aggregate, Plans deposit 55c. O. L. Kipp, ch. engr.

Minnesota—State Hy. Dpt., Rochester, crushed rock surfacing for Maintenance Div., crush, screen, load and haul approx. 28,630 cu. yd. traffic-bound crushed rock wearing course, Olmsted Co. $26,000 (unofficial).

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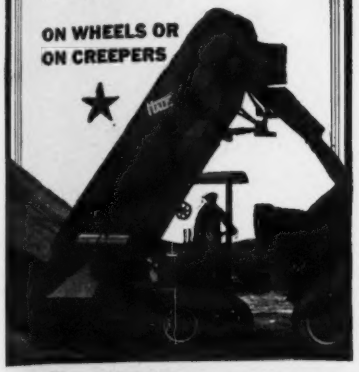

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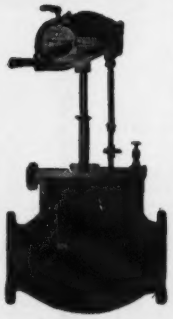

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STREETS and ROADS (Bids Asked, Cont'd.)

Bids Asked July 14

California—State Hy. Div., G. T. McCoy, ch. engr., Sacramento, imported base material and applying armor coat 4.7 mi., between Crescent City and Smith River bridge, Del Norte Co.; plant mix surfacing and applying Class C medium seal coat 5.6 mi. Contra Costa Co.; plant mix surfacing 7.8 mi. hy. between Tehama Co. line and Chester, Plumas Co.; plant mix surfacing, grading 13.6 mi. hy. between Cebada Canyon and Buellton, Santa Barbara Co.; widening existing road bed with imported borrow, plant mix surfacing between Ignacio and Sears Point, Marin and Sonoma Counties.

Delaware—State Hy. Dpt., F. V. duPont, chn., Dover, graded earth roadway and drainage structure 0.9 mi. Contr. $34, Kent Co. W. W. Mack, ch. engr.

Bids Asked July 15

California—State Div. Hys., State Bldg., Los Angeles, plant mix surfacing 4.4 mi. hy. between Los Angeles city limits and Ventura Co. line, Los Angeles Co. G. T. McCoy, state hy. engr.

Bids Asked July 16

Kentucky—State Dpt. Hys., Frankfort, bituminous concrete surfacing 1.251 mi. SP 7-24, SN-SP 7-4 and SN-SP 7-124, Bell Co.; rock asphalt seal 7.721 mi. SP 15-54, 90-5, Bullitt and Nelson Counties; 0.563 mi. SP 62-1, 62-61 and 62-141, Larue Co.; grading, draining, low type surfacing 0.16 mi. SP 30-177, Daviess Co.; bituminous resurfacing 1.459 mi. SP 33-43, Estill Co.; 0.445 mi. SP 109-128, Taylor Co.; bituminous concrete paving 1.103 mi. SP 64-13, 64-33 and 64-53, Lawrence Co.; bituminous concrete resurfacing 0.947 mi. SP 87-17, 87-57, SN-SP 87-37, 87-117, Montgomery Co.; grading, draining, high type surfacing 0.728 mi. SP 117-349, Webster Co.; grading, draining and bituminous surfacing 1.399 mi. SP 45-31, 45-211, Greenup Co.

Bids Asked July 17

Oregon—State Hy. Comn., Pub. Serv. Bldg., Portland, grading, sidewalks, 0.03 mi. paving Yeon Ave.-Nicolai St. Project, Multnomah Co.; grading, 0.07 mi., paving 8 Ave. Bway. sect. of Hilyard St., Eugene, Lane Co.; 11,400 cu. yd. crushed rock in stock piles on McKenzie Hy., at Belnap Springs, Deschutes and Lane Counties. R. H. Baldock, State House, Salem, engr.

Bids Asked

Kentucky—State Dpt. Hys., Frankfort, rejected bids June 4, rock asphalt seal 7.721 mi. Bullitt and Nelson Counties. CD 5/13—ENR 5/27, under LB.

R. I., Newport—City, City Hall, (selected bidders) bituminous penetration wearing courses, roadwork, Plans deposit $25 each set. $35,000.

Texas—State Hy. Comn., Austin, cancelled bids to have been opened June 22, asphaltic concrete leveling course and seal coat 44.72 mi. Bexar and Atascosa Counties; 27.241 mi. Wilson Co. CD 6/14.

LOW BIDDERS

†**California**—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, road construction, repairing, No. 1356, Santa Barbara Co., from Brown, Doko & Baum, Box 23, Pismo Beach, over $40,000.

★**California**—State Div. Hys., Sacramento, June 23, imprv. 8.1 mi. Mendocino and Humboldt Counties, from Close Building Supply Co., 721 C. St., Hayward, $26,011***7 mi. Fresno Co., from M. W. Stanfield, Box 230, Marysville, $45,368***5 mi. Humboldt Co., from Mercer-Fraser Co., 2 and Commercial Sts., Eureka, $44,370***5 mi. San Joaquin Co., from Louis Bjasotti & Son, 40 W. Clay St., Stockton, $58,035***5.8 mi. Placer and Yuba Counties, from A. Teichert & Son, Inc., P. O. Box 1113, Sacramento, $45,844***7.2 mi. Kings Co., from Warren Southwest, Inc., 2145 E. 25 St., Los Angeles, $70,408***5.2 mi. El Dorado Co., from McGillivray Constr. Co., P. O. Box 373, $33,846***9.7 mi. Contra Costa Co. and 5.4 mi. Alameda Cc. from A. J. Raisch, 46 Kearny St., San Francisco, $151,093 and $41,054 respectively. CD 6/4—ENR 6/10.

California—State Hy. Dpt., 808 State Bldg., Los Angeles, June 24, imprv. 7.5 mi. Ventura Co., from Oswald Bros., 366 E. 5 St., Los Angeles, $80,885; 14.7 mi. Imperial Co., from R. E. Hazard Contg. Co., P. O. Box 1510, San Diego. $58,794.

★**Illinois**—State Div. Hys., Springfield, June 18, concrete paving 1.4 mi. Route 50, from Thos. McQueen Co., 1313 Circle Forest, Forest Park, $243,712***0.75 mi. State Aid Route 051 (Pulaski Rd.), from Wm. J. Sheppard & Co., 2519 N. Wayne St., Chicago, $208,520, both Cook Co.***concrete pavement patching Route 9, Fulton and McDonough Counties, from Jansen & Schafer, Pekin, $51,992***concrete pavement widening 3.15 mi. Route 113 (north), from U.S. Hy. 45, Bourbonnais NW to Will Co. line, concrete pavement relocation 3.73 mi. Route 113 (north) from Kankakee Co. line northwest to Chicago Rd., Kankakee and Will Counties, from Scheflow & Monahan, Glen Ellyn, $254,450***bituminous resurfacing and dual 2 ft. concrete widening 8.37 mi. Route 16, Montgomery Co., from Bridges Asphalt Paving Co., 1411 Central Industrial, St. Louis, Mo., $209,853***bituminous resurfacing 7.37 mi. Route 49, Vermilion Co., from S. G. Hayes & Co., 600 S. Michigan St., Chicago, $90,680***bituminous resurfacing 3.3 mi. Alternate U.S. Hy. 66, and 4.08 mi. U.S. Hy. 30, Will Co., from Walsh Oil Co., Joliet, $186,055.

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STREETS and ROADS (Low Bidders, Cont'd)

Kentucky—Dpt. Hys., Frankfort, June 25, imprv. 0.84 mi. Greenup Co., from J. C. Codell & Co., Winchester, **$60,198*****4.83 mi. Jefferson Co., from Highland Co., Inc., 644 Baxter St., Louisville, **$28,517*****4.478 mi. Laurel Co., from Lehman-Roberts Co., 615 Citizens Bank Bldg., Lexington, **$62,064*****5.731 mi. Leslie Co. and 0.57 mi. Madison Co., from O. V. Arnett, Berea, **$192,861** and **$28,899** respectively. Received no bids June 25, imprv. 0.966 mi. Washington Co. CD 6/8—ENR 6/10.

Maryland—State Rd. Comn., Baltimore, June 22, grading, drainage, concrete surfacing 1.13 mi. from Governor Ritchie Hy. toward ferry terminal at Sandy Point, Contr. AA-255-10-37, Anne Arundel Co., from Empire Constr. Co., 31 S. Calvert St., Baltimore, **$184,101.**

Ohio—State Hy. Dpt., Columbus, June 22, bituminous treatment 29.77 mi. Athens, Hocking and Morgan Counties, from L. P. Cavett Co., 511 Shepherd Ave., Lockland, **$69,452**, est. $69,669***18.62 mi. Athens and Meigs Counties, from Paul Varga & Sons, 1385 Norton Rd., Columbus, **$25,883**, est. $25,940***37.64 mi. Coshocton, Knox and Tuscarawas Counties, from C. J. Shelly, Thornville, **$33,804**, est. $34,367***22.98 mi. Franklin and Union Counties, from Allied Corp., 714 Keith Bldg., Cleveland, **$34,953**, est. $35,510***30.98 mi. Fulton, Lucas and Williams Counties, from L. Baker, St. Joe, Ind., **$29,867**, est. $30,548***26.7 mi. Medina and Wayne Counties, from Bucyrus Materials Co., P. O. Box 268, Bucyrus, **$57,975**, est. $59,023. Received no bids June 22, imprv. 20.50 mi. Perry Co., 24.64 mi. Hocking and Vinton Counties, 12.64 mi. Cuyahoga Co. CD 6/17.

Texas—State Hy. Dpt., Austin, June 22, imprv. 11.903 mi. Lamar Co. and 2.277 mi. Brazos Co., from Austin Road Co., 1813 Clarence St., Dallas, **$43,418** and **$107,651** respectively, est. $40,000 and $110,000 respectively*** 22.428 mi. Potter and Carson Counties, from Jack and Vowell, Rte. 2, Box 25, El Paso, **$199,538**, est. $200,000***15.338 mi. Carson and Hutchison Counties, from Public Constr. Co., Denton, **$115,737**, est. $120,000***1.244 mi. Jefferson Co., from Chas. Cohen, Marshall, **$85,460**, est. $90,000***16.975 mi. McCulloch and San Saba Counties, from McKinney Constr. Co., Marshall, **$53,765**, est. $60,000***0.71 mi. Colorado Co., from Geo. Kies, 1700 Pease Rd., Austin, **$55,777**, est. $50,000. CD 6/14 and 6/15.

Wisconsin—State Hy. Dpt., Madison, June 25, imprv. 1.432 mi. Park Ave., in Beloit, Rock Co., from Jesse H. Freeman, P. O. Box 246, Moline, Ill., **$113,979.** CD 6/16.

CONTRACTS AWARDED

†Arizona—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, addnl. dust control work, Yuma Co., to Tanner Constr. Co., P.O. Box 1832, Phoenix, under **$200,000.**

†Arkansas—U. S. Eng., 300 Broadway, Little Rock, roads, Drew Co., to T. L. James Co., Inc., Ruston, La. Est. **$100,000.**

†California—U. S. Eng., 1209-8 St., Sacramento, streets, spur tracks and addnl. paving, Spec. 588, Fresno Co., to J. E. Haddock Ltd., 3538 E. Foothill Blvd., Pasadena, under **$50,000.**

†California—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, shoulder stabilization, Contr. 509-eng-4967, Los Angeles Co., to Bonadiman-McCain, Inc., 1709 W. 8 St., Los Angeles, **$50,000-$100,000.**

†California—U. S. Eng., 74 New Montgomery St., San Francisco, sealing stabilization and texture, Contr. 868-ENG-5428, Sonoma Co., to A. Teichert & Son, 1846 37 St., Sacramento, **$50,000-$100,000.**

†Florida—U.S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, limerock base course, bituminous binder and wearing courses, etc., Cont. 436-Eng-10208, Hillsborough Co., to Brinson Constr. Co., and J. L. Cone & J. D. Manly, Caesar St. and Cumberland Rd., Tampa, **$500,000-$1,000,000.**

†Florida—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, roads, Neg-Jax-43-987, Monroe Co. to Mike Blank Nursery, Delray Beach, under **$50,000.** Awarded 6/21.

†Florida—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, bituminous dust palliative, Lee Co., to Cone & Manly, Caesar St., Cumberland Rd., Tampa, under **$50,000.** Awarded 6/24.

†Florida—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, sidewalk, curb and guard rail, Neg-Jax-43-1027, Palm Beach Co., to M. P. Crabtree, 532 15th St., West Palm Beach, under **$50,000.** Awarded 6/21.

†Georgia—U. S. Eng., Post Office Bldg., Savannah, road paving, Contr. 819-Eng-1560, Bibb Co., to R. B. Tyler Co., Monroe, N. C., under **$50,000.**

†Georgia—U. S. Eng., Post Office Bldg., Savannah, grading, paving, Contr. 819-Eng-1563, Tift Co., to Scott Constr. Co., Thomasville, under **$50,000.**

†Idaho—U. S. Eng., Pittock Blk., Portland, Ore., grading, paving, Power Co., to Morrison-Knudsen Co., 319 Bway., Boise, **$100,000-$500,000.**

Ill., Alton—E. Linkogle, city clk., 33,000 gal. MC-1 asphalt, 950 tons ⅝ in seal aggregate, to The Havelka Co., 434 E. Broadway, East Alton, asphalt at **$1.25** per gal.

Ia., Hampton—Bd. Supervs. Franklin Co., imprv. 144.5 mi. roads, to Paul Constr. Co., Fort Dodge, **$40,270.** Bids 6/21, awarded 6/21. CD 6/16.